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Contents:

	PAGE
India	237
Our Stand at Birmingham	238
The Coal Mines Bill	238
The E.R.A. Report	238
Instrument Design	238
The Indian Political Situation and the Electrical Industry, by J. W. Meares *(illus.)*	239
Hydraulic Power Accumulation, by A. Page *(illus.)*	242
Instrument Progress in 1929, by A. C. Jolley	246
Electricity for the Home	249
Business and Industrial Notes	250
Lighting and Power Notes	255
Tramway and Railway Notes	256
Telegraph and Telephone Notes	257
Radio Notes	257
Contract Information	258
Forthcoming Events	259
Notes	260
Institution Notes	261
Our Personal Column	261
Financial Section—	
New Companies Registered	263
Official Returns of Electrical Companies	263
City Notes	264
Financial Section—*contd.*	
Stocks and Shares	265
The Physical Society's Exhibition—IV *(illus.)*	267
The Thirsk Totalisator *(illus.)*	268
Aylesbury's Rural Area *(illus.)*	270
Internal Isolation Switchgear *(illus.)*	271
Electricity Supplies to Large Buildings	273
Factory Illumination	275
Legal	276
Parliamentary News	276
Correspondence—	
Joints for Aluminium Bus-bars	277
Coal Mines Bill	277
Ferranti	277
Standardisation	277
Heavy-oil Engines for Isolated Plant	278
Overhead-line Towers	278
Standardisation of Voltage	278
The Disadvantages of Prepayment Meters	278
"Quote Our Reference"	278
I.E.E. Centre Dinners	278
Motor-convertors as Power Factor Correctors	278
Published Specifications	279
Trade Mark Applications	279
New Work for Contractors	280

India.

IN view of the prominent place which anything relating to India occupies in the mind of the world at the present time, we have devoted a good deal of space in this issue to a contribution on the political situation there and its relation to the electrical industry. The writer, Mr. J. W. Meares, C.I.E., M.Inst.C.E., M.I.E.E., has had a unique experience, extending over a period of twenty-five years, of Indian electrical affairs. His knowledge of Indian life in general has also been exceptional by reason of his travels in all directions away from the beaten path. His Indian work began in an engineering capacity, though by far the greater part of the lengthy period mentioned was spent in the administrative and advisory work of a Government official; but it was during his close and varied study of Indian life and conditions in the course of hydro-electric survey and other operations that he accumulated most valuable experience, and at the same time consistently and conscientiously endeavoured to further the interests of the electrical industry. On his retirement some seven years ago he was made the subject of a presentation by civil, mechanical, and electrical engineering friends at a meeting of members of the Institution of Electrical Engineers there. During his terms of office Mr. Meares had to think about the purchaser, the consumer, and the Government, but his connection with India ended with a return to what he then termed "real engineering" when he was placed in charge of the hydro-electric survey. In leaving for home he testified to the great assistance that the electrical engineer had rendered to ameliorate the conditions for all classes and creeds. We mention these facts as a reminder of the qualifications of the author of our article, which differs somewhat from our periodical news from India, inasmuch as it constitutes a view of the current and prospective position of affairs as it appears to an electrical authority of wide experience whose continuing interest in the vast lands is obvious from the fact that at the time of writing these notes he is on a return visit to the East.

As our readers peruse Mr. Meares's very interesting and spirited review of the factors likely to affect electrical trade development, they may find it appropriate to bear in mind what the exact situation has been during the

past eighteen months as revealed by the recently published statistics. For instance, our exports of electrical machinery to British India amounted in the full year 1929 to £1,386,700, a decrease of £125,751, but India was still Britain's most important overseas market (Elec. Rev., January 24th, 1930). Later information, however (see Elec. Rev., January 10th, 1930), showed that there was a marked improvement in the first half of 1929-30, calculated in this case from April to September last, for there were satisfactory increases in the Indian imports of electrical machinery and apparatus, our share thereof advancing from Rs. 83 lakhs to Rs. 92¼ lakhs. Germany's share, though comparatively small, showed a larger rate of increase, but that of the U.S.A. actually fell. It will be interesting to see what happens during the current half of the year, during which time the anti-British agitation has found organised vocal expression. It may be that notwithstanding our competitors' efforts to take advantage of that circumstance, the prejudicial effect will not be marked, or may not at once exist at all. Briefly, there seems no reason for slackening our efforts; rather should we be more active than ever.

Our Stand at Birmingham.

We wish to draw our readers' attention to the fact that we have a stand in the Birmingham section of the British Industries Fair—which opens at Castle Bromwich on Monday, February 17th—where the Electrical Review will be eagerly waiting to be of assistance to visitors, both home and overseas.

We are anxious to furnish any information which may be needed by either buyers or sellers. Your correspondence can be typed by us. Our telephone can be used by you—we will receive and deliver your in-coming calls. Our Lightning Messenger Boy Service will carry your messages within the Fair Building.

Note the number of the stand: **21-F4.**

Note the number of the telephone: **"Fair 51."**

The Electrical Review stand will be essentially a live business-stimulating office if you will make it so. A few years ago when the Birmingham Electrical Section was limply fading we came to the rescue and helped it to virility and strength. We still want to render all the help within our power, and we invite the industry to make full use of us.

An outstanding feature will be a large electric sign in colour picturing this journal making its constant circuit of the world, and naming the places in all quarters of the globe where we have regular weekly readers whose names are on our paid Subscription List alone, independently of those whose orders are filled through the great newspaper distributing houses. Stand 21-F4 will be lighted by a selection of modern fittings produced in this country and provided by Messrs. Troughton & Young.

The Coal Mines Bill.

Attention is drawn by Mr. W. B. Woodhouse in our "Correspondence" columns this week to certain provisions of the Coal Mines Bill which, if enacted, may be highly prejudicial to the electricity supply industry. These provisions appear to indicate a lack of co-ordination between State departments, as the Government, on the one hand, is backing a large-scale scheme with the object of making electricity cheaper and more extensively used (thus reducing the domestic consumption of coal), and, on the other hand, it is putting forward proposals which are likely to restrict the output of electricity, both by increasing the price of the raw material of the electricity supply industry and by subsidising a competitor, the retail coal industry, which is already more favourably situated due to the unfair incidence of recent rating legislation.

The measure may be regarded in two ways: (1) its effect on the cost of fuel, *per se*, and (2) its effect on the sale of electricity in competition with coal. With regard to the first, it may be conceded that the *direct* effect of any probable increase in fuel on lighting charges (which make the most immediate appeal to the large majority of consumers) will be negligible, but the development of electricity supply depends upon increasing sales of low-priced energy, such as industrial steam plants, water heating, general heating, industrial heating, and railways, particularly during off-peak periods when little more than the additional cost of fuel is charged in order to secure the business. The very much greater load on public supply systems due to the output at low selling prices introduces new technical and commercial factors, which make all the difference between large- and small-scale generation, and experience has shown the effects of these to be reflected in the charges for lighting.

Coal, regarded as a competitor, is often cheaper than electricity on a fuel basis, but improvements in industrial products, convenience, and operating economy, due to the use of the latter, are so marked as to make its substitution mainly a matter of educating the consumer, provided the present relation in price between coal for industrial and domestic uses and for electricity works is undisturbed.

Another point of importance is that the prices charged to consumers are often adjusted to meet variations in the cost of coal or may be regulated under contract by a "coal clause." Hitherto it has been the assumption that an increase in price of electricity due to such variations will be offset by similar increases in the cost of coal to the general public, but it might be, under the terms of the Coal Bill, that an industry taking its electricity from a statutory undertaking would be worse off than one having its individual generating plant. Under its Acts an electricity supply undertaking is not permitted to show undue preference between its consumers, and it is certainly most illogical that an industry, which is at once its competitor and the provider of its raw material, should be permitted to do so.

A rejoinder to Mr. Woodhouse, made elsewhere by the South Yorkshire Coal-owners' Association and referred to in our "Notes" section, does not remove our apprehensions; in fact, it confirms the intention of the coal-owners to show undue preference against the electricity supply industry.

The E.R.A. Report.

The ninth annual report of the British Electrical and Allied Industries Research Association was issued last week. It is gratifying to note that while substantial progress has been made in technical research, the financial position has been considerably improved. The easing of the pecuniary situation has been due to the recognition by electricity supply undertakings that it is to their own great advantage to support the Association's funds. The Association is to be congratulated on the results following its adoption of a policy of publicity, and it is to be hoped that the proposed revision of its constitution will effectively keep the need for adequate support from the constituent bodies well before them. Although immediate difficulties have thus been surmounted, we think that the industry should not rest satisfied with the position. In relation to the magnitude of the problems to be solved, which increases with the progress of the industry, the present income of the Association can only be regarded as a subsistence, and every effort should be made to secure the support of those undertakings which have not yet decided to shoulder their proportion of the expense.

Instrument Design.

During the past few weeks we have, as in previous years, brought to the notice of our readers the more important features of the Physical Society's annual exhibition.

In this number we publish a survey of progress made during 1929 in the design of electrical instruments. Though no radical departures from established practice are recorded, considerable improvements in detail may be noted.

In the opinion of our contributor, and instrument users generally will agree with him, British instruments now hold their own with those made in any other country.

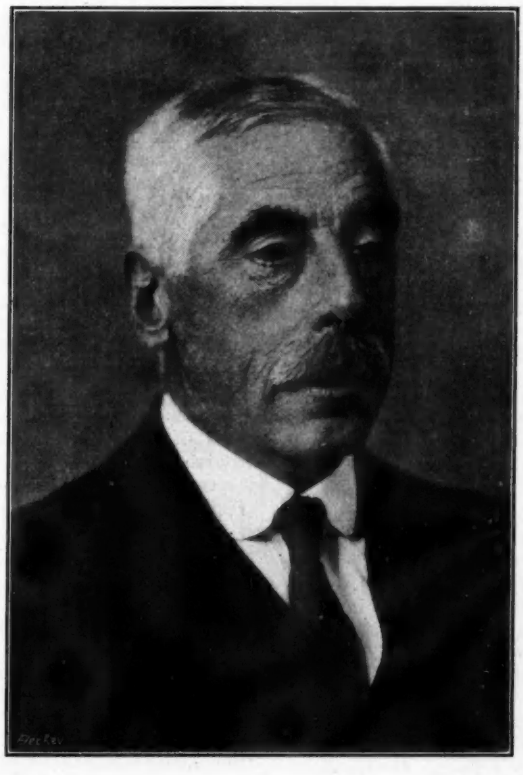
The Indian Political Situation and the Electrical Industry.

By J. W. MEARES, C.I.E., M.Inst.C.E., M.I.E.E.

(Formerly Electrical Adviser to the Government of India and Chief Engineer to the Hydro-Electric Survey of India.)

FOR better or for worse, industry and politics are becoming more and more closely intertwined all over the world, and even a non-partisan journal such as the ELECTRICAL REVIEW is bound to take notice of the trend of politics. America and Germany are two outstanding examples; the former has collected more than her share of the world's wealth, as the direct result of a policy which it is now impolitic to mention, and is endeavouring to secure a world hegemony of trade through political action, while the latter, having apparently lost all, is rapidly regaining it through a shrewd combination of industry and finance. In both cases the State Banks play a large part, and tariffs an even larger part, while nothing in the political situation that favours our competitors at our expense is allowed to pass by without being brought to notice by consular officers and "drummers."

We have also seen in the last year or two a very determined effort on the part of America to tackle us in a new direction, by gaining financial control of those of our successful industries that are not already partly Americanised; and the extent to which this process has already gone is known to few outside the close corporation of directors—for, as has been evident in all the recent crashes, shareholders are deliberately kept in the darkest ignorance until something startling happens. This process of obtaining control by the purchase of stock or shares has spread from manufacturing works to supply undertakings and from Great Britain to the "Dominions beyond the seas." These considerations apply to the whole of the British Empire, but to the Indian Empire in a greater degree than elsewhere for reasons which are perhaps little appreciated even in the City. Within the last few months we have seen the considered joint opinions of some of the most experienced Indian ex-administrators brushed aside as of no account whatever by the pundits of that country and the would-be pundits of this. It is a peculiarity of the East, I suppose, that a year or two after their retirement, the situation is said to have changed to such an extent that those who have ruled millions are no longer reliable guides as compared with time-serving politicians of the "Padgett M.P." type. No doubt the industrial situation in India—the misnamed "unchanging East"—has altered greatly since my retirement in 1922, but I was merely an adviser without executive functions, and not a ruler of millions, so my opinion may still be worth something. Incidentally, I think I can say that I have seen more of India than any man living or dead. Most of those whose lives are spent in the East remain in one or two Provinces throughout their service, whether they are in the public service or in business; a few high officials tour over a large part of the country for their last three or four years; but it was my fate—and a very interesting one, too—to travel over the greater part of India, from Bombay to the Chinese border of Burma and from the Khyber to Cape Comorin, throughout my 27 years' service, and to be off the beaten track much of the time. Yet I do not for a moment profess to know India as our politicians (beginning with the egregious Keir Hardie) know it.



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Mr. J. W. Meares, C.I.E., M.Inst.C.E., M.I.E.E.

It is no use shutting our eyes to the fact that India's millions, though in law British subjects—or would not "subjects-in-law" describe them with more domestic accuracy?—belong in fact to scores of oriental races having very little in common with us or with one another even, except that in every instance the weaker party in a dispute looks to British justice and not to religious or caste injustice for redress. But one thing is certain: the Indian trader is a fairly shrewd individual, and means to get the best bargain he can, without the slightest sentimental regard to the country of origin of the goods he buys; but he is being urged not to buy British goods at all, and the urge often takes the form of direct intimidation. Now the Indian shopkeepers (and the Indian politicians), unlike the itinerant pedlars from over the border, are not brave folk; they are like Kim's friend Hurree Babu, who professed to be a "very fearful man," and they acquiesce in the policy of boycott from sheer funk.

It is easy to jibe at the impatience of the politically-minded Indian, who has learned the lessons of history from us, but is in too much of a hurry to put them into practice. He would crowd our slow progress from Magna Charta to the Parliament Act into ten years and get impatient in the ninth. But, as always happens, the noisy extremist is the one whose views are accepted by the ignorant outsider as being representative. The wise insider knows better than to encourage "The Call of the Old Chaos" as portrayed by Mr. Raven Hill (*Punch*, January 8th). The extremists themselves do not want it in reality, for they know well enough what their fate

would be in an independent India; but as they also know we shall not betray our trust to the inarticulate myriads, they can safely go on crying for the moon and grumbling when they hereafter get "Dominion status."

Britain prides herself on being democratic, which means of course being ruled by an electorate which selects place-seekers as its nominal representatives, knowing well that the latter are servants of a party caucus with as much independence as a dog on a chain. India, on the other hand, has always been a vast collection of autocracies, and yet we are committed to trying to turn it into something on democratic lines. One consequence of this is that India claims, and no doubt rightly claims, freedom to manage (or mismanage) her own tariffs in what she conceives to be her own interests; and similarly to purchase the goods she requires without any regard to sentiment—or, rather, with pronounced anti-British sentiment. Not so many years ago most of the cotton fabric of which clothes of some hundreds of millions of people are made came from Lancashire, whereas now a large proportion of it is either made in Indian mills or imported from Japan; while Mr. Ghandi continues to preach that it should all be "khaddar" made from indigenous cotton on hand looms, thus advoiding even the indirect use of British machinery in electrically-driven mills. Again, it is not long since the large purchases of Government stores for the railways, the Army supply service, and the Public Works and allied departments, were made almost exclusively in London from British firms. Now a large proportion of these purchases is made in India, and it is the official policy that there shall be no discrimination in favour of any but Indian goods, while it is the unofficial aim of the politicians that there shall be every possible discrimination against British goods.

To what extent this extremist policy of boycott is, or may hereafter be, successful, it is not easy to say; it is far easier to boycott legislative councils than piece-goods; but unquestionably it has helped to decrease the advantage which the British merchant has considered his birthright ever since the days of "John Company," and has at the same time been disadvantageous to India herself. Quality is unfortunately of far less interest to the native trader—there, I knew that forbidden word would creep in—than price, a fact very clearly indicated in the trade returns and in the reports of Mr. Ainscough, the Senior Trade Commissioner. The purchasing power of the country has increased considerably in recent years, but the (once) "United" Kingdom's share of the total trade has diminished seriously, and will continue to diminish until we get a move on. One obvious cause of the decline, about which one dare not say much in these days, is the huge rise in wages all over Great Britain, as compared with pre-war standards, with very little to show for it in harder work; an excellent thing in itself (the rise, not the failure to work) but dangerously apt to deplete the fund from which all wages are paid, by raising the cost of goods above the competitive level. That, coupled no doubt with wild finance during the post-war boom years, is why our staple coal and cotton trades are being knocked out by countries where the price of labour is lower and the hours of work are longer. On the other hand, the policy of local purchase of Government stores (where quality is still paramount) has stimulated the inauguration of industries in India, which is highly satisfactory and desirable. In this field electricity has already played a large part and is destined to play a larger.

Whatever may hatch out from the deliberations of the Simon Commission (already short-circuited) it is quite clear that we are committed in advance to further progressive instalments of self-government or Swaraj, with that vague goal known as "Dominion status" somewhere ahead. Ever since Lord Morley introduced his reforms, the Councils in the various major Provinces and the central Government have been adding to their powers. Budgets are framed with both eyes on the minute fraction of the population that elects these Councils, and business men recognise that they must shape their policy accordingly. In trade and commerce, healthy rivalry has not led to hatred and contempt; the relations between the Indian and the British merchant are on the whole thoroughly good, for each is indispensable to the other. Furthermore, though a fabulous amount of stored bullion is still hoarded in "the grave of the precious metals," the present-day Indian freely invests in British-controlled local industries. That in itself is a very valuable asset, especially in the case of electricity supply concerns which make life more tolerable to every race and caste, the just and the unjust, the constitutionalist and the extremist.

Huge though the population of India is, most of it is engaged in agriculture, and can expect no benefits from electricity for generations to come. Even the kerosene oil lamp is a luxury that is often absent. It is only in and near the towns that electricity supply can at present find a place. In this direction much has been done in recent years, and on the whole done well. Naturally the great Presidency towns are in a class by themselves, and the foresight of those who envisaged their electrical worth has been well rewarded. For a good many years there was very slow progress in other towns, with the exception of Himalayan hill-stations where water power is found, and coal is prohibitive in price. Gradually, however, the possibilities of the lesser towns forced themselves on the notice of business men, and a number of these now have a public supply on a paying scale. One of the earliest of these is an object-lesson worth a digression. A very wealthy Nawab desired to have electric light and fans in his palace, and decided at the same time to light the streets of his town at his own expense. The work was well carried out, and some surplus power was available, which was sold to other residents. This, of course, involved business arrangements, so the whole concern was after a time put into the hands of lay trustees, who were free to extend the plant and mains on borrowed capital, but were given the original capital expenditure free of interest and all charges. Nevertheless, the business rapidly drifted into the region of insolvency, and it was eventually sold to a company for a fraction of its cost; it has paid handsomely ever since under progressive management on both the technical and business sides.

Nowadays, as the columns of the ELECTRICAL REVIEW testify, there is a constant stream of applications for licences and of new companies—mostly with small capital—for supply in the lesser townships; and, as the sale price of energy can be varied widely to suit the conditions, most of them should pay. Once current is available, it soon becomes a necessity. Electric fans are of course the mainstay of these supply undertakings, especially the smaller ones, and the high load-factor that results from their long hours and months of almost continuous use dominates the situation. As consumers, the small body of Europeans in any such place does not count for a great deal, especially as many of them are liable to disappear during the hot-weather fan season, when even missionaries are impelled to hold conferences in cool places at high altitudes. The Indian, however, when he is not too poor, is very much alive to creature comfort. Meters are a bugbear, both because of their high cost in a very small installation and also because of the fraudulent manipulation of them which is all too easy and all too common, and is regarded as a venial offence by compatriot magistrates.

An astonishing thing about India is that the domestic appliance which is even more necessary than the fan, namely, the refrigerator, has made little progress. Here we have ready to hand an apparatus which could without detriment be switched off for an hour at peak load by a time-switch (which could similarly operate water-heating elements) and yet be required for the other 23 hours a day for a large part of the year—*all* the year in many parts of the Peninsula and Burma. If companies specialising in this class of work were to send out competent agents (of which more anon) to demonstrate and push electric refrigerators, they would surely reap a good harvest (there you are, my American friends · chip in quickly while we think it over.) The apparatus would generally have to be let out on hire or hire-purchase, and admittedly there are difficulties in collecting small recurrent charges in the East when the hirer defaults, and still greater difficulties in getting the apparatus back out of the shrine or purdah place where it is sure to be in-

stalled. Remember, however, that meat killed in the morning may be obnoxious the same evening; that ice is a necessity rather than a luxury, and is not always made from pure water; and that the few hundred fans which we originally contemplated for Calcutta have become tens of thousands; and it will be seen that the refrigerator may be worth a campaign.

Here again I digress to point out that the greedy eye of the politician is cast on these undertakings at times. A few years ago a Bill was introduced into the Legislative Council seeking to enact that when a licence was applied for in any area, the local authority should have the prior right to it, *i.e.*, that when business men had spent time and money in prospecting and were sufficiently satisfied with the prospects to apply for powers, the local body could step in and reap the fruits of their labour. The Bill was thrown out, but it shows the spirit still prevailing in the matter of what the politicians call the exploitation of India. This egregious Bill was sponsored by Mr. Patel, whose name is better known now than it was then.

The Governments in India, both Imperial and Provincial, are more concerned with State semi-commercial enterprise than in most countries. It is not socialism under an alias, but plain common-sense development of resources for the benefit of the people, and on a revenue-paying basis, where otherwise no such development would take place. The outstanding example is the immense irrigation system of northern India, which could never have come into being by private enterprise, but under State management has turned the desert into fertile land with a handsome dividend to boot. One company was indeed floated to build a great canal and waterway; its history is a sad one and may remain in oblivion.

Most of the railways also are, or will eventually become, State lines, some of them being primarily strategic lines which no company could have undertaken. Thus it is not surprising that some electrical development has followed the same course. The earliest State electrical undertakings were for cantonments, either purely military like Fort William, in Calcutta, or combined with civil stations as in many towns all over the north. At first there was a tendency, due purely to unnecessary red-tape, to give civilian residents a supply from these military works on sufferance only, and as a favour, and to refuse it when the plant was fully loaded. That policy was obviously both unfair and unwise, as no company could possibly operate in an area with the cream skimmed off, and a valuable source of revenue was sacrificed to ridiculous objections of the Finance Department. Nowadays I believe common-sense prevails, and the civilian need not sweat because the soldier must be kept cool. But there is no redress if the supply fails or is unsatisfactory, for Government is not subject to a licence and only to a limited extent to the rules in force.

At present many of the Provincial Governments are either carrying out or contemplating hydro-electric projects. The preliminary reconnaissance which my colleagues and I carried out of the water power resources of India, though very incomplete, is bound to bear good fruit in the course of time; and after the "Reforms" abruptly put an end to the survey as an Imperial concern, it was carried on provincially in several large areas. A large scheme is now being carried out in Punjab, by the Government, which created a special department to deal with it, and good progress is reported. The project is a bold one—I think almost a gamble—so bold that it is unlikely that private enterprise would have ventured upon it, seeing that it assumes a very large expansion of mechanical industries in a mainly agricultural area, as well as the electrification of all those at present working, coupled with bulk supply to the present scattered supply undertakings. There has been some searching of hearts, and a good deal of local criticism, as to the ultimate fate of the venture, in view of the capital charges that must accumulate while it is making good; but if it succeeds it will have far-reaching effects, and Government does not become insolvent over a bad break. The necessity of tapping off the e.h.p. transmission lines at a large number of points *en route* is the feature which differentiates it from the three successful Tata schemes in Bombay, the lines from which run unbroken to that city; and yet it is to be noted that with power from these three works available, the Great Indian Peninsula Railway has put up its own steam plant at Kalyan.* On the other hand, fuel is far more expensive inland in the Punjab than at the port of Bombay. When a successful method of drawing power from a transmission line without the present complications and expense has been evolved, as it surely will be, such undertakings as that in the Punjab will have a better chance.

The Punjab's nearest neighbour, the United Provinces, is also forging ahead with hydro-electricity under Government auspices, but on a more modest scale. Some years ago a considerable artificial fall on the Ganges canal (which is a fair-sized canalised river in effect) was harnessed for power; and now other similar falls are being roped in by a special Hydro-Electric Department to feed a common network of mains. In this way a sound undertaking can be built up piecemeal as the demand increases. For, unlike fuel stations, comparatively small water power plants can be highly economical in operation, even though expensive in first cost, especially if some of them are of the automatic type. This is another opening for our manufacturers—or for America. There is, I believe, a large field for the utilisation of these irrigation canal falls as automatically-operated plants, feeding into a not too extensive network; and often there is an opening for power for pumping canal water to areas above the command of gravity. Should the United Provinces eventually want power on a larger scale, the Province has some fine sites awaiting development.

Madras is always represented as a backward Province but in this matter of electricity supply she is well to the fore. She has immense resources of water power and is starting to develop them under a Hydro-Electric Department of Government, as her progressive neighbour Mysore did thirty years ago. There is even talk of Bengal having a "grid" fed from the Khasia Hills of Assam, where the meteorological humorist reported "Cherrapungi, 35 inches; raining." Slowly but surely the huge water power resources of India and Burma will be made use of, though they are often remote from civilisation. To couple India with China and Siberia, as was done in a recent publication† is simply a libel on a land that will not be hurried. As these various undertakings and schemes come into being, there will be a large demand for every sort of machinery and accessories.

Railway electrification is now a fact in Bombay, both main and suburban, but even the latter remains unsettled elsewhere. It cannot be long delayed in Calcutta, where the congestion is acute. The cable tunnel which the Calcutta Electric Supply Corporation is about to construct under the River Hoogly may be the precursor of tube railways there, which have already been the subject of expert report. Electric tramways exist in various cities, but there does not seem much prospect of further lines, either in India or for that matter elsewhere, except perhaps of the railless variety.

Sooner or later the narrow-gauge railways connecting up the various hill-stations will inevitably be electrified, especially now that the advantages of regenerative braking are being demonstrated on the broad-gauge line up the Western Ghats of Bombay. These hill lines mostly rise some 5,000 feet on steep grades—one indeed on an Abt rack—and the transport and cost of fuel for them is very severe when set against water power close by. In this matter Government has not been enterprising.

In conclusion, a word may be said about representation in India. Much ink has recently been spent over the discussion of commerce and trade in relation to the universities, or, bluntly, whether men of good breeding are more useful in business than the type of man found at an "ordinary" in the local hotel. So far as home trade goes, the stock commercial traveller seems to fit his job; but the highly-educated man has an undoubted ad-

* See ELEC. REV., November 22nd, 1922.

† "Power Resources of the World," reviewed by the present writer in *World Power* for May, 1929.

vantage when it comes to selling specialised wares such as our industry manufactures. The East, however, is a different proposition altogether; trade and commerce are there very sharply differentiated, though it might puzzle a definition-monger to demarcate them; and even more sharp is the distinction between a superior and a subordinate and between a sahib and a mere European. No one is quicker immediately to discern into which class a man fits, than a cultivated Indian. The Americans found this out long ago, but many British firms have still to learn it. It is essential, as the President of the British Chamber of Commerce recently said, that salesmen sent out from home to sell goods should have some sympathetic understanding of the minds of the people he is among—just as much as it is so in diplomacy. The language question, and that of weights and measures hardly arises, as the Indian trader mostly uses English standards and knows enough English to carry on.

Those who have the responsibility of choosing men for the Indian public services very seldom find a man so outstanding that his inferior social status can be ignored. Snobbish? May be, but necessary when dealing with people who were highly civilised when we still dressed ourselves with woad. There is plenty of room for the public school man and the university man in Eastern commerce, and plenty of new business to be made and lost business to be recovered by him, provided he knows his subject inside out and keeps up his status in all his dealings.

Having written this, I am going out to Bombay by the next boat; friends please accept this, the only, intimation. Business men, please follow and see for yourselves.

Hydraulic Power Accumulation.

A selection of Continental installations is described to illustrate the widely varied application of such plant; not only can heads of 100 ft. be economically employed, but the capacities also can range from a few hundred to many thousand horse-power.

By A. PAGE, B.Sc., A.M.I.E.E., A.M.I.Mech.E.

IN a previous article* various fundamental features of hydraulic power accumulation were discussed, and it was shown that, although such installations had not so far been erected in this country, their adoption would nevertheless prove a valuable asset in improving plant load factor. Indeed, with the interlinking of our power supplied by the "grid," the introduction of water-power storage comes much nearer to realisation, as some of the transmission lines are bound to traverse country decidedly favourable to such schemes. As the cost of transmission lines would in any case be incurred, energy could be stored during periods of light load for a comparatively small additional expenditure, and returned when necessary with an overall conversion efficiency of 65 per cent. If, therefore, electricity undertakings consider a night load tariff of 0.375d. per kWh well covers their expenses, and at the same time boast of 1d. per kWh as the average price secured for all services, it would surely be wise for them to store surplus energy at the lower rate until more urgently required, even if it did incur the above mentioned loss.

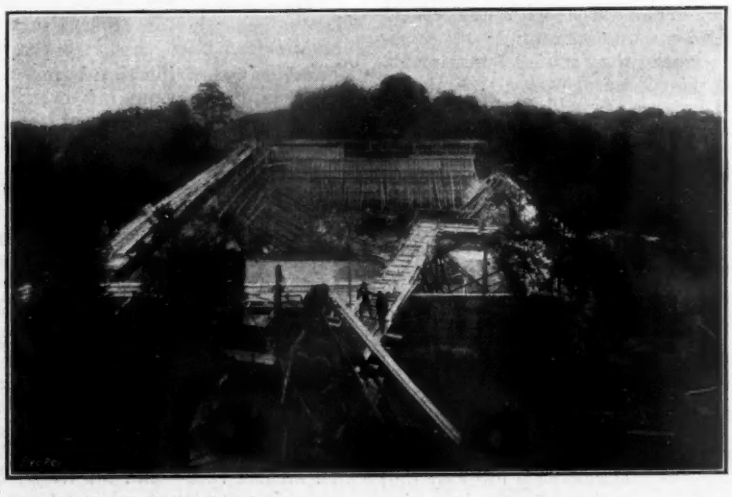


Fig. 1.—Reservoir at Tübingen.

The object of the present article, however, is not to discuss the economic aspect of the subject, but to illustrate how widely varied has been the successful application of the fundamental principle. For reasons previously touched on the majority of the Continental installations are operated in conjunction with water power plant, but, nevertheless, the economic advantage derived from them remains unquestionable, whatever the source of electricity supply. The first equipment selected as an example is the relatively small and simple plant at Tübingen, which was actually installed to replace an electrical accumulator, but which now fulfils the additional function of supplying energy at times of peaks. It is interesting to note the reservoir, fig. 1, designed for daily storage on a basis of 16 hours pumping and 8 hours turbine operation, is constructed of reinforced concrete and is entirely artificial. It is 145 ft. long, 82 ft. wide, 20 ft. deep, and has a content of 1½ million gallons. At the right-hand corner of the illustration will be seen the control house, which contains the remotely-operated inlet valve to the pipe-line, the water-level recorder, and the alarm device. The pipe-line, protected at its inlet by a screen, is of mild steel, 16 in. in diameter and 2,000 ft. long

The water turbine, fig. 2, is of the over-hung Francis type, and is coupled by a clutch to an alternator in series with a d.c. generator, which in turn drives, through a further clutch, the storage pump. When running at 1,500 r.p.m. the turbine develops 288 h.p. under a net head of 374 ft., and it is arranged for external regulation controlled by an automatic governor combined with a pressure regulator. The twin generating set may also

* ELECTRICAL REVIEW. December 27th, 1929.

be employed, when required, to act as a convertor, since d.c. is sometimes available from an adjacent steam station, and a.c. from a water power supply. The clutches on either side of the set can be engaged and disengaged whilst running, so that great latitude in operation is available. The pump can be driven by either of the generators acting as a motor, and delivers 1,130 g.p.m. against a manometric head of 400 ft., absorbing 188 h.p. In the same manner as the electrical connections can be varied, so the water distribution can be controlled by valves, the one pipe-line to the reservoir serving both for supplying the turbine and for delivering the water from the pump.

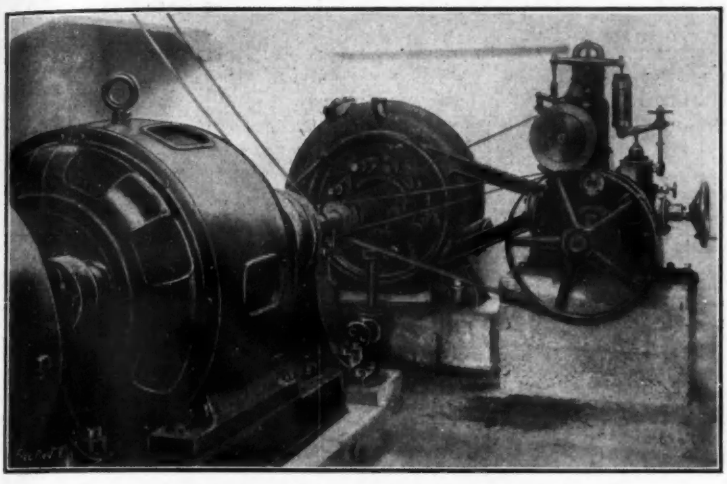


Fig. 2.—Water-turbine Set at Tübingen.

Whilst the Tübingen installation forms but a modest example of hydraulic power accumulation, it contains in a nutshell all the necessary elements, and admirably demonstrates the minimum requirements for its application. First, there is the entirely artificial reservoir with only one pipe-line; secondly, there is the moderate head and moderate capacity; and thirdly, there is the extreme flexibility of both the electrical and hydraulic interconnections. The latter point is a characteristic feature of most water-power storage equipment, and it is brought into greater prominence at Fridingen, where the plant embodies not only the elements found at Tübingen, but also operates conjointly with high-pressure and low-pressure water turbines.

A general view of the machine room is given in fig. 4, whilst fig. 5 is a section at one of the three groups. Before the war two small hand-operated wall-type turbines of 30 h.p. each were installed, but they were soon found too small to meet the increasing demand, and additional power had to be brought from the water-power station at Lauffenburg. The advantages of special night rates soon became apparent, and it was decided to construct a storage plant for making use of this cheap supply, and also for meeting peaks. As at Tübingen, an entirely artificial reservoir of reinforced concrete, oval in shape, 360 ft. long, 180 ft. wide, and 24½ ft. deep, with a capacity of 7 million gallons, was constructed on the adjacent hillside. This reservoir connects to the power house at the foot of the hill by means of a pipe, 1,740 ft. long, made in three sections of 26 in., 24 in., and 22 in. diameter, respectively.

The inlet valves situated in the valve house are arranged for automatic closing in the event of pipe fracture, as is essential. The twin high-pressure Pelton turbine, fig. 5, running at 1,000 r.p.m., operates under a head of 540 ft. and generates 740 h.p. As a result of this high speed, the wheels are of relatively small diameter and each could be cast in one piece. Each wheel is served by two nozzles, the four nozzles being controlled by one common automatic speed regulator, which also acts as a pressure regulator. The water to each wheel can be cut off independently by a separate valve, in addition to which a main inlet valve is provided in the pressure pipe before the breeches piece to the various groups. Next to the turbine is a 500-kW alternator, with a clutch on either side, the exciter being separately driven by a belt. At the extreme end of the group is the three-stage storage pump, fig. 4, absorbing 610 h.p. when delivering 2,640 g.p.m. against a manometric head of 578 ft. The pump runner wheels and guide wheels are made of cast steel, whilst the housing is of cast iron. On both the suction and delivery pipes are control valves, with the addition of a non-return valve on the delivery side. In the breeches pipe a further non-return valve is situated after the main control valve. For checking the performance of the plant, one Venturi meter is situated in the main delivery from the pumps, and one in the main water supply to the high-pressure water turbines, but the two pipes join at a point 160 ft. outside the machine house before leading up to the reservoir.

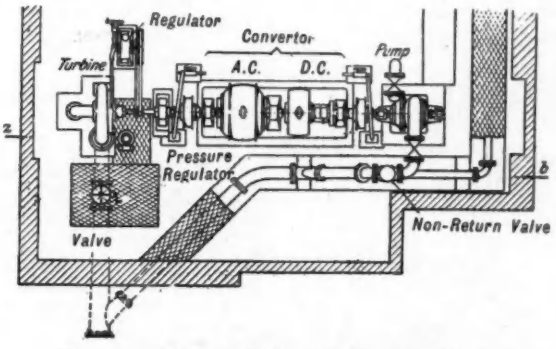


Fig. 3.—Plan of Tübingen Engine Room.

At the same time as the above plant was under construction, it was determined that, by cutting a large detour off the Donau river, a head of 49 ft. could be obtained. Therefore, a further scheme was conjointly placed in hand of constructing a tunnel 4,600 ft. long terminating at a dam near Fridingen station. From this point the water was led to the same power house as above, but at a level 37½ ft. below the main machine room floor. By this means considerable

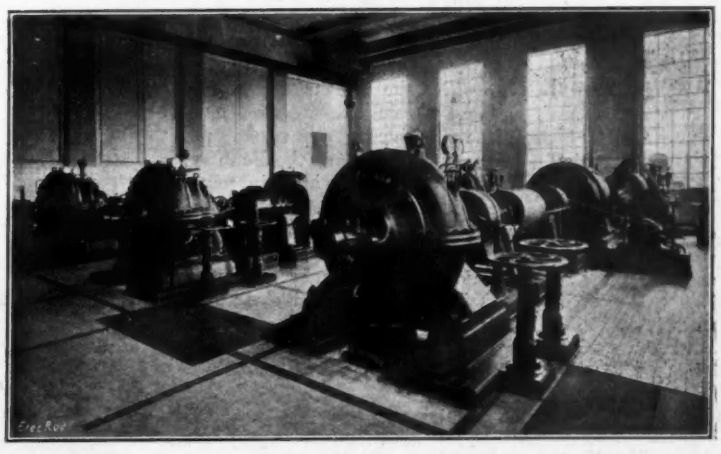


Fig. 4.—Engine Room at Fridingen.

building and operating expenses were saved, in addition to which the energy generated from this fall made the Fridingen supply independent of the Lauffenburg water power station, and the storage plant could be driven by

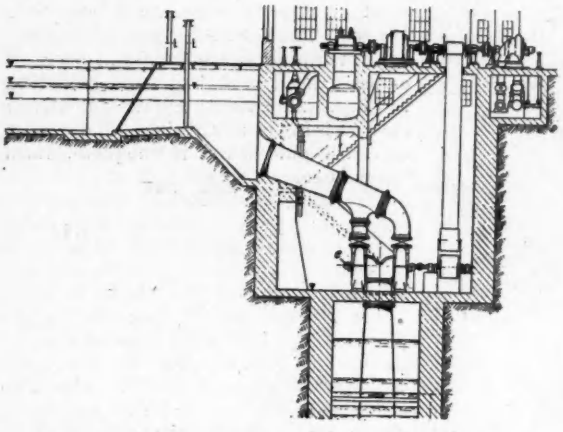


Fig. 5.—Arrangement of Plant at Fridingen.

the power derived from the Donau river. Initially one low-pressure twin spiral, and one double-spiral turbine were ordered, each rated at 740 h.p. when operating under 49 ft. head at 525 r.p.m. A third turbine has, however, now been installed to develop 960 h.p. The blades of the runner wheels are of sheet steel, cast into a heavy rim. The machines are fitted with guide blades for external regulation, and are automatically controlled by oil pressure regulators. In the case of the twin spiral turbine, each casing is served by a separate valve so that, if required, one-half of the turbine can be shut off. In each case, the turbine shaft is rigidly connected to a belt pulley, 3 ft. 3 in. in diameter, acting as a flywheel, the belt being held on to the driving pulley by a damped belt tightener. Although the drive is almost vertical, no trouble has been experienced in transmitting the large output in question, in addition to which the belt on the main floor level can be disengaged by an ingenious arrangement. The overall length of the combined group at this point is almost 50 ft. All the couplings are of the Benn type, and can be engaged and disengaged whilst in motion.

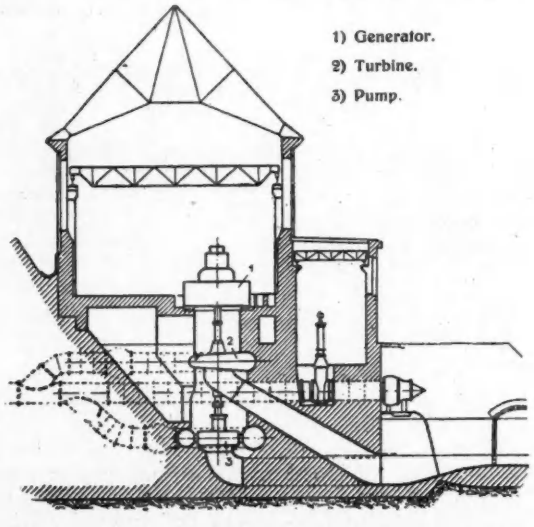


Fig. 6.—Section through Hemfurth Power House.

With the above described machine, the following duties can be performed :—

1. Driving the pump by means of an external power supply, the alternator acting as a synchronous motor. For this purpose the belt drive is lifted clear of the pulley, and the high-pressure turbine is de-clutched.
2. Driving the pump by the low-pressure water turbine. The alternator and high-pressure turbine are both de-clutched.
3. Combined drive of the pump and alternator by the low-pressure turbine. In this case the high-pressure turbine alone is de-clutched.
4. Combined drive of the alternator by the high- and low-pressure turbines. The storage pump is de-clutched.
5. Driving the alternator by the high-pressure turbine alone. The belt drive and the pump are de-clutched.
6. Driving the alternator by the low-pressure turbine alone. The high-pressure turbine and the storage pump are both de-clutched. It will thus be seen that exceptional latitude in operation is possible, and that each portion of the group can be made to fulfil its respective function in turn, as and when the load and available water quantities permit.

It is often considered that water-power storage schemes can only be successfully applied when very high heads are available. This, however, is quite erroneous, and in fact the lower limit of head appears in recent years to be progressively decreasing. It will be as well, therefore, to include a few particulars of the plant at Hemfurth, which is of reasonably large capacity, but nevertheless operates under only 135 ft. head. There already existed on this site a barrage with several turbines, serving to cover the peak supplies of the Prussian Oberweser Company, but as usual their outputs were soon found to be too small for the requirements. Connected to the barrage were six discharge valves, and, by a piece of skilful engineering, the capacity of the existing station was increased by 100 per cent. by arranging for a water turbine and a pump to connect to two of these discharge pipes, with an additional pumping set on to a third. A section through the power house is given in fig. 6, and shows the vertical disposition of pump, turbine, and alternator, with a readily uncoupled rigid coupling between the pump and the turbine. Previously the amount of water discharged from the dam bore no relation to the quantity of energy generated but to the water requirements of the Weser. By the addition of the above sets and the introduction of a low level reservoir, surplus current could be employed for pumping water into the lake, where it was always available for meeting peak loads.

The vertical Francis spiral turbines are rated at 7,750 h.p. at 1,000 r.p.m., when operating under 135 ft. head and utilising 3,950 g.p.s. The pumps are constructed for dealing with 3,020 g.p.s. against 123 ft. head, absorbing 8,250 h.p. at the same speed. When the head decreases to 75 ft. the water quantity can be increased to 3,850 g.p.s. Both the pumps and turbines are arranged for external regulation, the guide vanes being operated by oil pressure from the regulator pump. Fitting the pump with guide vanes has the advantage, in addition to that of raising the efficiency at partial loads, of permitting the pump to start more easily. Also, should the electricity supply fail, the pump guide blades are automatically closed,

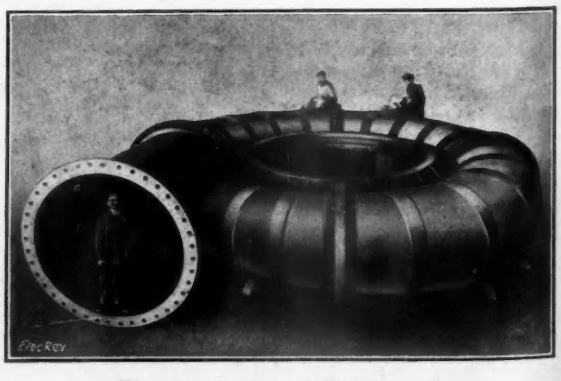


Fig. 7.—Casing of Hemfurth Pump.

shutting off the delivery pipe, quite apart from the rotary valve, which is also provided for this purpose.

The higher the head the less costly is the plant for the same capacity, in addition to which the quantity of water to be handled decreases proportionately. At the other extreme to the plant at Hemfurth are the pumping sets at Tremorgio, operating under a total head of 3,020 ft. When surplus energy is available, water is pumped from the river Tessin in the Southern Gothards into Lake Tremorgio, from which it can be tapped at times of peak load for generating additional current. As the Tre-

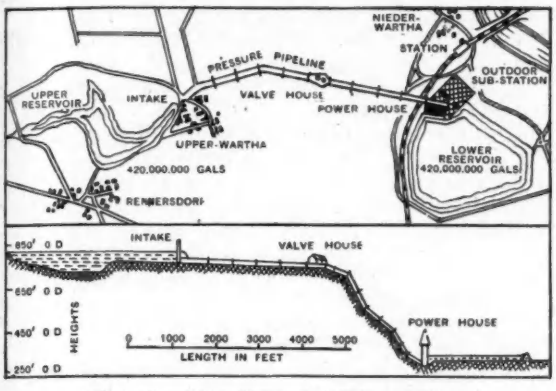


Fig. 8.—Site Plan at Niederwartha.

morgio pumps absorb 13,400 h.p., their design was a matter of no small engineering skill, pumps of such size and for such heads never before having been manufactured. It was not deemed advisable, however, to construct the pumps in one casing, first, as the capacity of the existing crane was limited to 30 tons and, secondly, as greater latitude in operation and higher efficiency at partial loads could be obtained by adopting a twin design. Accordingly a gear, having two pinions, was fitted to the existing 750-r.p.m. water-turbine-driven alternator, and each pinion was arranged to drive one pump shaft. When at rest an elastic coupling can be engaged on the alternator shaft, whilst one of the pumps is provided with an electric clutch which can be engaged whilst running.

Each of the pumps is designed for delivering 5,400 g.p.m. against a head of 3,020 ft. when driven at 1,000 r.p.m., the suction water being supplied from a chamber protected by a sand separator and a clarifying basin. As there are no non-return valves on the suction branches, the pump casings are primed by a water jet ejector. A regulating valve and a non-return valve of special design are, however, situated in the delivery pipeline. They are so arranged that should they suddenly be called into action on failure of the supply of electricity whilst pumping, no excessive pressure surges are created. Again, on starting up the pumps with the delivery valves closed, dangerous heating might arise from the energy dissipated, to prevent which an automatic valve opens, allowing a small flow of water through the pumps. A section through one of the pumps is reproduced in fig. 9, showing the nine stages and the special thrust balancing device at the high-pressure end. Fig. 11 is an external view of the pump with the hydraulic ejector in the foreground.

The pumps at Tremorgio, whilst notable for their high head, do not by any means represent the largest pumps so far constructed for hydraulic power accumulation. In this class we have the plant installed at

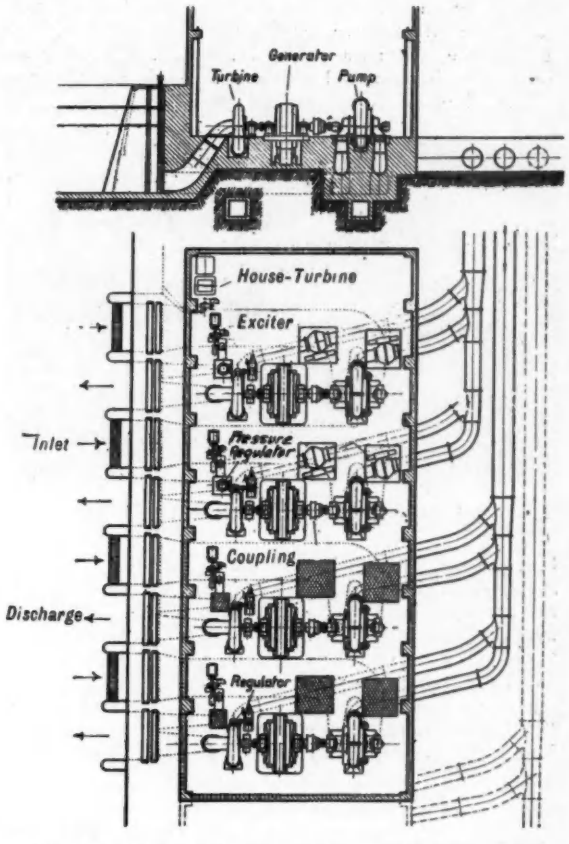


Fig. 10.—Plan of Engine Room at Niederwartha.

Niederwartha, which operates in conjunction with the power supply to Dresden. The Niederwartha scheme was one of the first in which energy generated by steam

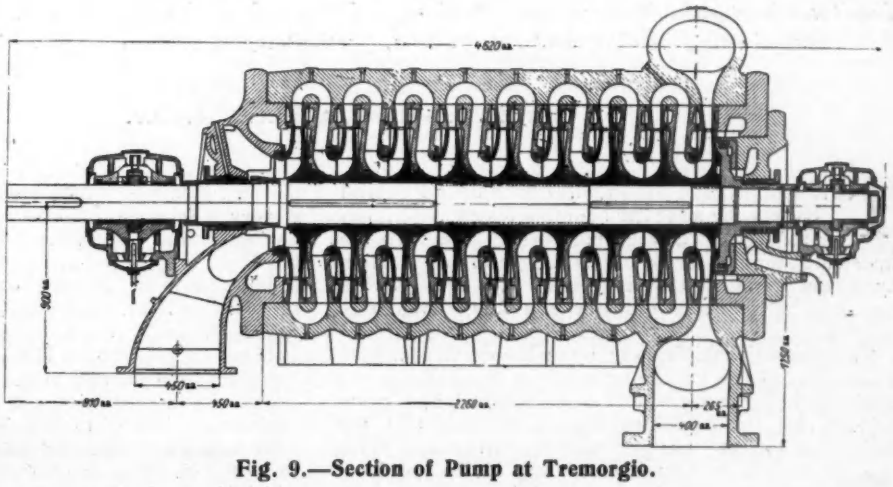


Fig. 9.—Section of Pump at Tremorgio.

power was employed for hydraulic power storage, and a close study of this installation will well repay investigation. Power is brought to the site by overhead lines and transformed to the requisite pressure by an outdoor transformer and switching station. Two reservoirs are arranged each containing 420 million gallons, the level in the upper reservoir being 460 ft. above that of the lower, fig. 8. Two parallel pipes lead from the upper intake to the control house, these pipes being 3,400 ft. long and 10½ ft. in diameter. From this point run two further lines 2,600 ft. long, the diameters of which pro-

gressively decrease from 11½ ft. at the control house to 8 ft. at the power house. The valves, 11½ ft. in diameter, are actuated by oil pressure, and automatically close in the event of pipe fracture. This operation is effected by an arrangement utilising the Venturi principle, the oil pressure for closing being obtained from a separate oil-pressure supply, which, for increased reliability, is connected with a dead weight accumulator.

The plant at Neiderwartha comprises four 30,000-

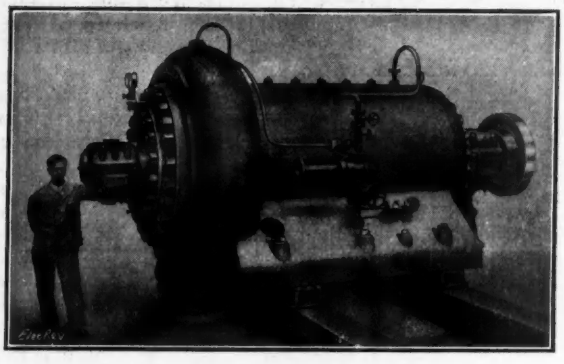


Fig. 11.—A Storage Pump at Tremorgio.

h.p. groups, arranged as shown in fig. 10. The horizontal spiral turbines are constructed of cast steel, and are arranged with overhung runner wheels. Under an average head of 432 ft. and with a water quantity of 3,850 g.p.s., 27,000 h.p. is generated by each turbine at 575 r.p.m.; the power rises to 30,000 h.p. under maximum head conditions. As usual, the turbines are fitted with automatic speed governors and pressure regulators for the pipe-line. The alternators are rigidly connected on the one side to the turbines, and on the other the pumps are driven by friction clutches, which can be engaged whilst in motion. The pumps each deliver 2,310 g.p.s. against a head of 485 ft., when running at 375 r.p.m., and absorb 25,000 h.p.; the water quantity can be increased to 2,600 g.p.s. when the head falls to 452 ft. The construction of these pumps is rather special, in so far as they are provided with one main double inlet impeller, having on either side a small auxiliary stage for leading the water into the main stage and generating a small portion of the total head. By this means the glands need not withstand the total pressure and the design becomes much simplified The main pump stage is provided with automatically controlled guide vanes, which close in the event of electrical supply failure and prevent the pumps being driven as turbines, the closing operation being regulated to prevent an excess of pressure in the pipe-lines. For serving each group, a separate horizontal spiral Francis turbine is installed, having an output of 380 h.p. driving directly, first, a d.c. generator supplying the exciting current to the alternator, and, second, an oil pump for the pressure oil to the bearings, the oil being employed for relieving the heavy bearing pressures on starting up. When fully extended, the plant at Niederwartha will be able to supply a peak load of 130,000 kW, and the total energy will be practically instantaneously available. It affords an outstanding example of what can be accomplished with hydraulic power accumulation.

This new branch of engineering is being pioneered by Messrs. Escher, Wyss & Co., Zurich, Switzerland, who have been responsible for practically all the hydraulic equipments herein described. They were also the main contractors for the installation at Niederwartha, and the author is indebted to them for permission to reproduce the various illustrations.

Instrument Progress in 1929.

The twentieth exhibition of the Physical and Optical Societies indicated steady progress in the manufacture of electrical instruments, particularly in workmanship and interior finish.

By A. C. JOLLEY, A.M.I.E.E., F.Inst.P.

THE exhibition of the Physical Society and Optical Society, by annually bringing together the latest products of a large number of representative instrument-making firms, forms an admirable medium by means of which the progress of this ever-growing branch of the electrical industry may very conveniently be reviewed.

The twentieth exhibition this year has shown that very steady progress is still being made in the manufacture of electrical instruments, and it is perhaps not too much to say that the exhibition reveals the fact that the British instrument maker produces instruments which are unsurpassed by any other country in the world.

It cannot, however, be said that this year has been marked by any very bold steps or remarkable innovations, but rather that attention has been concentrated on perfecting those models which have been shown in previous years.

One still notes with some regret that extensive slabs of exposed ebonite are prominent in the construction of precision instruments, although here and there the demands of experimental work at audio and higher frequencies necessitate the abandonment of the practice in the interests of efficient screening, and the metal top takes its place. It is, of course, perfectly true that the polished ebonite and lacquered brass or tin finishes make a very handsome combination while they are in a new condition. But in ordinary laboratory service the handsome appearance soon disappears, and the insulating qualities of the ebonite deteriorate under exposure to light. Moreover, as a mechanical support to plug contacts, it is none too satisfactory, for usually it is not long before its lack of rigidity spoils the good taper fit of the inserted plug.

The greater convenience of the rotary brush and fixed stud contact has led to its being very widely adopted by most manufacturers, and several excellent designs are to be found. One notable advance is the double brush which Messrs. H. Tinsley have further developed during the past year. A double brush-making contact on an upper and lower surface of the contact stud was employed by Messrs. Leeds & Northrup, of America, many years ago, but the rigidly-held brush was unsatisfactory; in the Tinsley contact the defects of the early type have been entirely overcome by making the brushes self-bedding, both in the stud and contact ring, and, by "ganging" the arrangement, a switch for carrying heavy currents can be made simply and satisfactorily.

Resistances, bridges, potentiometers, &c., with concealed decade dials, are now fairly general, and,

although it is claimed that with such a system the maximum of protection is obtained in use, a vague feeling of uncertainty must necessarily be associated with them, for it is not possible to see the condition of the contact between the brush and stud, and its partial failure through oxidation or any other cause is only detectable by separate verification. The demands of high-frequency testing have also necessitated considerable modifications in the construction of resistance coils, and most manufacturers are now producing coils with very low residual reactance. Two schemes are adopted: in the first the residual capacity and inductance are balanced against each other, while in the second scheme the winding is carried out so as to make both negligibly small.

In decade dial resistances of this type Messrs. H. Tinsley, realising that the component coils must always be used in the series arrangement, compensate each separate step on the dial for minimum reactance, for no matter how carefully the individual coils may be compensated, it does not follow that when a number in series are put in circuit by the dial switch the compensation will be as good as that of the individual coils. No solution to the problem of eliminating the effect of the unused, or dead-end, coils has yet been found. Another minor point in connection with the construction of high-frequency apparatus deserves attention; it has been the custom in the past to provide a fairly heavy and handsome moulding at the bottom of the mahogany containing boxes of resistances and other similar pieces of apparatus, and this prevents their being assembled as closely as certain high-frequency work demands, when every inch of connecting lead has to be considered. If this embellishment were dispensed with it would be both an economy and convenience.

It is interesting to notice that terminals in all types of electrical apparatus still escape the attention of the inventive designer; with the exception of one or two unsuccessful attempts at modification, terminals are as they were when electrical apparatus was first constructed, despite the imperfections with which every experimentalist is familiar. There is still considerable room for improvement in this detail, not only as to the form of the terminal, but also to the position it should occupy on the apparatus, which, it is feared, is now more governed by symmetry and appearance than anything else.

One interesting modification in the insulation of the pillar-supported terminal has been introduced by Messrs. H. Tinsley, who make the ebonite pillar with a deep outer petticoat which comes down over the actual supporting insulator for practically the whole of its length; in this way the actual length of path for surface creepage is considerably increased, while the inner surfaces of the ebonite are preserved from dust and from the destructive action of light.

The adaptation of the potentiometer principle to alternate current testing is rapidly extending, and several complete equipments for this purpose on both the vector and co-ordinate principles are being made for ordinary and audio-frequency. In one of the latest forms of this apparatus, due to Mr. D. A. Oliver, a screened ironless phase-shifting transformer has been developed, together with an ingenious phase-splitting device which only requires resistance adjustment, so that it can be employed at audio-frequency.

The precision variable air condenser has now reached a high state of perfection, and in order that this may be so, great attention has to be paid to mechanical perfection in its construction. The use of silica quartz or pyrex insulation is now quite general, both on account of its excellent dielectric qualities and its small thermal expansion, and the horizontal rotational axis of the moving element has many advantages in securing greater mechanical constancy. The Sullivan-Griffiths condenser is one of the most important modifications of recent times. Here the dielectric gaps on each side of the moving element are in series instead of being in parallel, as in the usual form, this being achieved by having what is in effect a double system of interleaving fixed plates, which are the electrodes of the condenser, whose capacity is varied by moving between them a series of coppered-glass plates carried on the rotating spindle. In this way the dielectric gaps are complementary, and the capacity for any given position of the moving plates remains constant irrespective of any change in the vertical position of the moving plates between the fixed ones. Several refinements have been introduced into the design during the past year, so that the calibration accuracy is very high and permanent. A unique feature of the instrument is the absence of any flexible or rubbing contact to the moving plates, so that this source of uncertainty in the ordinary form of condenser is entirely eliminated.

The improvement of the variable air condenser has directed attention to the inaccuracies which may arise in the inductance coils which are frequently used in association with them in the electric circuit. In the ordinary forms of single-layer coil it is obvious that a change in temperature must produce a change in the form of the coil. If the supporting body on which the winding is placed has a larger coefficient of thermal expansion than that of the wire, then not only will the initial stress in the wire be increased, but the supporting material may not return to its original form on cooling, and a consequent instability of the inductance will occur. This problem has been attacked by Mr. W. H. F. Griffiths for Messrs. H. W. Sullivan, and a new design of coil has been produced. The inductance of a simple coil is proportional to the diameter and to the turns per unit length. If, therefore, the former on which the coil is wound is made of a composite insulation, the end cheeks determining the diameter and the body material determining the length by suitably choosing the thermal expansions of the two materials, the variation of inductance due to diametral expansion are compensated by those due to expansions of the length; this is achieved by making the end cheeks of bakelite support a stout tube of loaded ebonite, which is slit longitudinally across two diameters so that its diametral expansion does not affect the form of the coil. With this construction it is claimed that a considerable increase in constancy and permanence is obtained.

In the commercial instrument section it is interesting to see that advances are being made in the scientific design of instrument bearings, for without a perfect bearing most of the other good features of a design may be lost. Messrs. Everett, Edgcumbe's research department has been giving much study to the selection of the most suitable steel for pivots, and has been investigating the proper chemical and heat treatment necessary. Toughness is secured by using a high-carbon steel, and the abrasion of the surfaces in contact is minimised by the elimination of free carbide.

Most manufacturers now realise that nothing shortens the life of a bearing more readily than shock or vibration, and many firms are now employing spring-supported jewels which, incidentally, secure much greater uniformity of assembly.

The idea of the spring-supported jewel is, of course, not new, but what does not seem to have been adequately provided for in most designs is protection against transverse vibration, which may be just as disastrous as vibration in an axial direction. It was to meet this difficulty that Mr. Foster, of the Foster Instrument Co., of Letchworth, designed his well-known "Resilia" movement, in which the spring-supported jewels are able to yield to vibration in both directions, and at the same time a very resilient support is afforded to the jewel without any material increase in axial length; this still remains as probably the most freely supported bearing yet designed.

The magnetic suspension is theoretically ideal for instruments with a vertical axis of rotation. It is, therefore, interesting to find that the Cambridge Instrument Co. is this year applying it to the moving-coil instrument. Actually the function of the magnetic suspension is to provide a frictionless bearing, and it is doubtful if any form of it would prove entirely satisfactory under conditions of shock or severe vibration, for, with

any displacement, the magnetic symmetry is necessarily disturbed in such a way that the restoring forces are diminished and the displacement tends to become worse, so that, unless some form of mechanical constraint is employed to define the rotational axis, the bearing is very liable to become deranged, but when such restraint is employed, some of the advantages of the bearing are lost. Moreover, the application is practically limited, in indicating instruments, to those of the moving-coil type, because it would be both difficult and undesirable to introduce magnets for the purpose in most other types. The employment of cobalt-steel magnets appears to be steadily, if slowly, on the increase, particularly when the total weight of the instrument is of importance, but the cast-steel magnet does not yet seem to be very much in evidence.

The use of the nickel-iron alloy Mumetal is, however, rapidly growing. It is possible, on account of the high permeability at low inductions of this material, to construct a very efficient light-weight magnetic shield, and this possibility may well prove eventually to be a deciding factor in bringing the moving-magnet Thomson galvanometer again into general use, particularly when cobalt steel is employed for the magnet system, and therefore the troublesome effects of self-demagnetisation can be delayed for longer periods.

Another valuable use for these alloy irons is in the construction of the movements of moving-iron instruments. Here the low hysteresis and small retentivity are of very great importance, and, with proper attention to other details of design, instruments can now be constructed on the moving-coil principle which are independent of frequency over a range which has never before been possible. At the same time, a material reduction in the weight of the movement becomes possible, and it should be pointed out that any reduction in the weight of a movement not only increases the life of the bearing, but usually means a reduction in the inertia of the movement; this very greatly simplifies the problem of obtaining satisfactory air damping, since the damper, in the main, is required to oppose the inertia forces.

Instrument transformers seem to have reached a state of great precision, and current transformers are obtainable with a ratio correct to one part in ten thousand from 10 to 150 per cent. of their rated current, while the phase displacement does not exceed 0.8 minute of arc. When such figures as these are compared with those obtained on transformers in 1908, it is easy to appreciate the great advance which has been made.

Here, again, the nickel-iron alloys have found a useful field of application, and by constructing the cores of this material it is not only possible to obtain a very small ratio and phase-angle error, but it can also be made practically constant over the whole working range. Such perfection of accuracy means that currents of several thousand amperes are now measurable with an accuracy which is unattainable by any other means. The induction-pattern instrument, which in its early form was unsatisfactory because of its large frequency and temperature errors, has now been greatly improved.

Conrad, in America, showed many years ago that by employing the series transformer principle these errors could be compensated, and a modification of this principle has been very successfully developed by Messrs. Nalder Bros. & Thompson, so that indicating instruments of first-grade accuracy are being produced. It is now possible to obtain a long-scale wattmeter with a maximum reading of 2.5 watts and with a low-resistance current coil. This year the principle has been adapted to frequency measurement, and a wide range of indicated frequency can be obtained in a single instrument with practical independence of applied voltage.

In connection with recording instruments, it is interesting to note that at least two firms are chart-driving by means of synchronous motors. This is an important step now that frequency control is becoming quite general, and where an alternating-current supply is available it is possible to eliminate that most troublesome and expensive adjunct of the recorder, the chart-driving clock.

Messrs. Everett, Edgcumbe have been pioneers in the direction of the control of frequency with their master frequency meter and the admirable little Warren motor, which is proving itself invaluable wherever accurate timing is necessary.

Their latest application of the motor is to be found in a new and very accurate frequency recorder, in which the chart is driven by one motor, and, since the speeds depends strictly on frequency, a second continuously-running motor of this type is intermittently geared for a definite interval of time to the inking arm of the recorder, and is then released. The excursion of the pen will therefore measure the speed of the motor, and therefore the frequency of the supply, with considerable accuracy.

The recording type of instrument is generally undergoing steady improvement, and the great difficulties which beset the design of such instruments are being overcome. Intermittent marking recorders, in which the movement is free except for the short interval when the depressor bar forces of pointer to record its position on the chart, are now being very generally made, since they eliminate both the pen friction and the necessity of ink. Some very beautifully-constructed relay recorders on the original Olivetti principle were on exhibition, but, although the relay principle solves very neatly the pen friction problem, the necessary delay or lag of this type of recorder is not entirely overcome, for the motor, driving the pen and applying the counter-torque to the movement, has to be started and stopped, and this cannot be done instantaneously. Recording on a rapidly-moving chart remains practically unrepresented.

The metal rectifier and the vacuum thermo-junction are now being extensively used in connection with moving-coil instruments for a.c. measurements. The vacuum thermo-junction offers a very tempting proposition, on account of its immunity from frequency error, so that it can be employed up to the highest frequencies, where it is without a competitor. Unfortunately, to secure promptness of action, its overload capacity is generally very limited, and this may prove somewhat of a drawback, particularly in cases in which it is impossible to prevent occasional surging in the supply, so that an instrument of this type reading near the top of its scale is more easily burnt out than other types of thermal instrument.

In conclusion, it should be remarked that the workmanship and interior finish of the instruments which were so freely displayed impresses one with confidence and leaves but very little to be desired.

B.S.S. for Electricity Meters.

Although a revision of the British standard specification for electricity meters was issued so recently as April, 1929, a further revision has now been published by the British Engineering Standards Association. The new edition, however, differs from the 1929 edition only in the addition of a clause relating to the standard terminal-connections, and a series of diagrams illustrating these connections. These terminal-connections are a mandatory feature of the specification, and therefore constitute a very important addition which is of interest to both manufacturers and users of meters. The specified limits of error, which were appreciably reduced by the 1929 edition, remain unchanged, and it is of interest to note in this connection that meters having an accuracy within the limits laid down by the specification would be classed as Grade I if the proposals recently made by the International Electrotechnical Commission become effective, the majority of Continental meters with larger tolerances on accuracy, being classed as Grade II. Copies of this Specification may be obtained, price 2s. 2d. post free, from the Publication Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1.

Electricity for the Home.

This article stresses the necessity for efficient service by both electricity supply undertakings and installation contractors.

(COMMUNICATED.)

I CONSIDER that " Service " is one of the most important functions of an electricity supply undertaking, and just as great attention should be given by the management to this side of the business as it is usual to give to the economical running of the generating station, distribution, and costs.

What I mean by " Service " can be enumerated under the following heads:—

(*a*) Steady pressure at the consumer's terminals.

(*b*) A well-equipped showroom or showrooms where a consumer can see and be instructed in the use of labour-saving devices, &c.; can obtain reliable statistics of the costs of different services; and can be shown different wiring systems.

(*c*) Prompt attention to all complaints.

Headings (*a*) and (*b*) require no further comment, as they are self-evident; the point I wish to stress in this article comes under heading (*c*). The average householder knows little or nothing about electricity, and therefore is dependent in time of trouble on the undertaking which supplies him with his electricity. I will illustrate more clearly what I mean by taking a case in point: a friend of mine rented a new modern house within 100 miles of London, and shortly after he got settled in one of the first things he discovered was that he got shocks from all the wash-hand basins and the metal switch covers, and that every now and again the lights in certain rooms flickered or became unduly bright. What was he to do? Well, he did in the circumstances just what any sensible person would do; he read the rules and regulations on the meter card, and one rule he spotted was to the effect that in the event of a leak he was to report the matter at once to the supply company. That sounded easy, so he rang up the company and was duly put through to the Complaints Department, to which he reported a leakage on his installation. The girl at the other end, who answered, replied that the company did not attend to such complaints, and told him he should ring up the contractor who wired the house. My friend said he did not know who wired the house, nor did he know any contractor in the neighbourhood, and he suggested that the company should refer to the application form for the required information; this was done, but, unfortunately, the contractor's name had been omitted, but the builder's name was given. That terminated the matter so far as the supply company was concerned. It was then up to my friend to ring up the builder in order to find out who wired the house, which information was furnished in due course. The next thing was to ring up the contractor, who was given the facts of the case and asked to send a man to test and clear the fault; the contractor said he thought he could send a man along that day, but as he did not turn up that day or the day following, my friend rang up again on the third day, and again the contractor said he would send along at once, but it was not till three more days had elapsed that a man eventually turned up and did the necessary work. In other words, just a week passed between the time the supply company was informed of the leakage and the appearance of the wireman. Fortunately, in this instance, the leak was not very serious, but had it been and the main fuse blown and the house plunged into darkness, one can imagine the feelings of the consumer towards the supply company.

To my mind the attitudes in this instance, both of the supply company and the contractor were contrary to all good business methods, and reflected little credit on either. It is this sort of attitude that tends to retard the use and popularity of electricity. I have had a good deal of experience in the management of an electrical undertaking, and in one concern I was connected with, having some 20,000 consumers, we did pride ourselves upon one thing, and that was *service*. If any consumer reported a fault on his premises, we always sent some one along to examine his installation, and if it was only a matter of changing a lamp or something simple like that, our man was instructed to do it, so as to cause the consumer as little inconvenience as possible. No charge was made. If the wiring was faulty, we notified the consumer in writing, and told him he would have to have it put in order, and gave him the contractor's name and address. What is more, we followed the matter up and took care that the wiring was repaired, when we again had the installation tested. We were only too glad to have the opportunity of testing consumers' installations, as it was only by those means that we were able to ascertain that the standard of wiring generally came up to the company's regulations, and it also helped us to keep a check on the contractors.

There is little doubt that service pays in the long run, as a consumer who knows that his interests are being looked after by the supplier, and whose reasonable complaints are attended to promptly, is going to let his friends know, and that means more consumers. I came across a case of good service whilst I was in Scotland last summer. Unfortunately, it is not an electrical one, but it will serve my purpose of driving home what I am trying to get at. At the house in which I was staying a pipe burst, and the plumber was rung up; a girl answered the telephone, and in quite a short time two men appeared and repaired the pipe. Again, in the same house, on another day about 8 p.m., something else went wrong, and the plumber was again rung up. Within a quarter of an hour the plumber himself appeared; he had been at the local bowling green when he got the message, so he hopped on to his motor-bicycle and came round to the house at once, made a temporary repair, and had a man round the next morning at 7 a.m. That is what I call an example of good service, and should be emulated by all wiring contractors worthy of the name.

In order to encourage rural electrification, not only is a supply necessary, but service is also essential, as without it prospective consumers will only be discouraged. Service is simply a matter of organisation and attention to detail; the cost of such a system is a very small percentage of the total cost of supply, and money spent in this direction, provided always that the service is efficient, is money well spent.

No doubt many electricity supply undertakings have an up-to-date and efficient services already in operation, but to those who have not, the above remarks are directed.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Mr. Scullin and the Australian Tariffs.

A Melbourne correspondent of *The Times Trade and Engineering Supplement* says that Mr. Scullin, the Australian Prime Minister, addressing members of the Australian Association of British Manufacturers, maintained that in practically all cases in which British preference had been abandoned, Great Britain either supplied almost the whole of the imports into Australia, or did not supply any appreciable quantity. Australia's tariff and migration policy were not drawn up as an unfriendly gesture. They represented an honest attempt to build up Australia as a great and increasingly important part of the Empire. The president of the Association, after assuring Mr. Scullin of the Association's co-operation for the good of Australia and the Empire, said that while it was realised that the Commonwealth Government intended the tariff to help Australia, the Association could not welcome it with unmitigated enthusiasm. The British Trade Commissioner (Mr. R. W. Dalton) said that when it was realised that before the war the bulk of Great Britain's trade was done with countries closely protected by tariffs, the future of British trade with Australia was good, especially if Mr. Scullin's tariff had the effect of bringing prosperity.

A Sydney correspondent reports that there is already strong evidence of exploitation of the public by a section of retailers, although there is an apparent understanding between the Government and the Chambers of Manufactures in this matter. It is suggested that the position may be met by the institution of a price-fixing tribunal if necessary.

The American G.E. and Siemens & Halske.

It is announced that the American General Electric Co. is taking up a substantial part of the loan which is being raised in New York by Siemens & Halske, Berlin. The American issue amounting to $14,000,000 nominally is being offered at 233 per cent. and will therefore raise $32,000,000. The debentures will rank with the ordinary shares for dividend, but will be entitled to a minimum of 6 per cent. They will not carry voting rights. A further £500,000 (nominal) of debentures is being offered to the German shareholders at the price of 175 per cent., in the ratio of one to ten.

Upon being notified of the American General Electric's intention, the directorate of Siemens & Halske is reported to have said that it welcomed the American company's participation. According to the Berlin correspondent of the *Daily Telegraph*, a communiqué was issued stating:—"The pleasant and tried connection of our house with friendly firms at home and abroad would not thereby be affected. We anticipate that the new connection will also favour the further development of our relations with other leading firms in the electrical industry, and in this way we see a momentous step in the direction of solving the great problem with which the world still confronts electro-technology."

From these "diplomatically ambiguous" words it is generally inferred in Berlin that there is an intention to form a comprehensive electrical trust.

An F.B.I. Survey and Forecast.

The "Business Barometer" of the Federation of British Industries for the first quarter of the year reviews the conditions prevailing during 1929, and says that the recovery of our heavy basic industries and export trade which commenced in 1928 continued to make headway during the past year, though the rate of acceleration steadily decreased in the latter part of the year. The responsibility for this disappointing ending to what promised to be one of the best post-war trading years is to be attributed almost entirely to the abnormal condition of the international money market and the high level of money rates which was one of its principal features. It is suggested that the culminating point of the "first international business cycle movement since the liquidation of 1920-21 was reached last year. The American slump is attributed to the fact that prosperity was built up on "the unstable basis of an inflation of the current expenditure of retail consumers, as well as the general standard of living in the U.S.A., to a level much above that justified by the actual earnings of American citizens." This matter is studied at some length, and the conclusion is reached that recovery is dependent upon the speed of reduction of the world's money rates; the extent to which American and Central European banks co-operate to expand credit, without inflation; the willingness of investors to accept a smaller return upon their savings; and the restoration of the foreign capital market to something more nearly approaching its pre-war condition. It is emphasised, however, that the provision of "easier" money must be accompanied by "readjustments in the field of industry and commerce and an encouragement of openings for its profitable employment."

French Foreign Electrical Trade.

The appended tables show the French imports and exports of electrical machinery, fittings and allied material during the first nine months of last year as compared with the corresponding period of 1928. It will be seen that the imports made an advance of £1,399,600, or over 60 per cent., and that on the other hand, the exports increased to the extent of only £181,530, or about 7 per cent. The values have been calculatd on the basis of 124 francs to the £.

	Imports. Jan. to Sept.		Exports. Jan. to Sept.	
	1928	1929.	1928.	1929.
	£	£	£	£
Dynamo-electric machines, transformers and parts	394,145	624,290	648,340	491,325
Electrical apparatus	875,310	1,598,300	825,500	833,460
Incandescent lamps and parts	470,225	584,380	137,120	166,230
Arc lamps and parts	1,170	825	3,345	8,490
Carbons for lamps, dynamo brushes, &c.	69,460	95,040	167,310	195,840
Electric wires and cables	277,430	473,750	249,275	340,935
Electrical fittings and parts	130,515	166,170	179,780	240,510
Magnets	4,645	9,420	525	1,318
Accumulators and parts	27,590	48,120	107,435	188,985
Dry batteries and condensers ...	8,920	15,770	40,400	40,290
Porcelain and glass insulating material	16,830	59,775	84,360	117,540
Totals	£2,276,240	£3,675,840	£2,443,390	£2,624,920

Unemployment.

The number of persons on the registers of the Employment Exchanges in Great Britain decreased by 2,861 during the week ended January 20th, at which date the total was 1,473,400, as compared with 1,476,261 on January 13th, and 1,425,620 on January 21st, 1929.

Recent Contracts.

The BRITISH GENERAL ELECTRIC Co., of Wellington, N.Z., has recently received a number of orders, among them being one from the Auckland Electric Power Board for two 1,000-kW rotary convertors each with its 1,100-kVA 3-phase transformer and fully automatic switchgear. For the interconnection of the Waitaki (110 kV) and Lake Coleridge (66 kV) power schemes in the South Island, the company has received an order for seven 5,500-kVA, 63,500/38,100-V outdoor type single-phase auto-wound transformers. An order has also been received for auxiliary generating plant and switchgear for the Waitaki power station. This includes two 315-kVA, 3-phase, 50-cycle alternators, and two 120-kW, 230-V, d.c. generators, an 8-panel, 420-V, a.c. flat-back switchboard, and a 6-panel 220-V, d.c. flat-back board.

The BRUSH ELECTRICAL ENGINEERING CO., LTD., Loughborough, has received an order from Messrs. Stone & Webster, Inc., consulting engineers, Boston, U.S.A., for a 2,000-kW Brush-Ljungstrom turbo-generator set for installation at the Jamaica Public Service Department, Kingston, Jamaica. This is the second Brush-Ljungstrom set ordered by these consultants for service in Jamaica, the first one, a 1,000-kW set, having been installed in 1925.

E.D.A. Activities.

With the growth of motor transport and the need for labour-saving appliances in the garage trade, the British Electrical Development Association has turned its attention to the motor trade, and has produced four special leaflets (Nos. E.D.A. 783/1, 2, 3 and 4) in which the advantages of electricity for lighting, motive power for driving machine tools, electrically-operated car-washing pumps, and petrol pumps are outlined. Report No. E.D.A. 784 contains a brief review of the more common applications of electricity in the motor trade.

A series of lectures on the uses of electricity, particularly in the home, given by the E.D.A. to teachers of domestic science under the Leeds Education Authority, and to domestic science students at the College of Housecraft, at Leeds, were concluded on January 29th, and are now to be followed by an essay competition, descriptive of the course. The lectures have been given by Mr. C. F. Partridge, of the Leeds Technical College.

An International Tool Price List.

The British Hacksaw Makers' Association has sent us particulars of a new price list for hacksaw blades which comes into operation on May 1st next. This is an international list agreed by the American, British and German associations, and is believed to be the first international list for tools.

Barcelona Exhibition Awards.

In our last issue we reported that Venner Time Switches, Ltd., had been awarded a gold medal for a display at the Barcelona Exhibition. We now learn that the following companies also received gold medals:—The Cambridge Instrument Co., Ltd.; Erinoid, Ltd.; Evershed & Vignoles, Ltd.; Gent & Co., Ltd.; E. Green & Son, Ltd.; and Simplex Conduits, Ltd., Messrs. W. & T. Avery, Ltd., gained a diploma of honour.

For Sale.

The Dartford Urban District Council has for disposal one 2,350-kVA turbine direct-coupled to two 3-phase alternators 6,600 V with step-up transformer to 10,000 V. Messrs. George Skey & Co., Ltd., have for sale a number of second-hand a.c. 3-phase, 50-cycle motors and fittings. Mr. G. R. Lightfoot will sell by auction on February 19th and 20th, at 13, High Holborn, W.C.1, electrical appliances and accessories and wireless material. (See our advertisement pages to-day.)

Estonian Foreign Electrical Trade.

The *Board of Trade Journal* states that during November last Estonia imported electrical machinery, apparatus, and implements to the value of 278,000 kr. (£15,300). Exports of the same class were valued at 46,100 kr. (£2,500).

Polish Foreign Electrical Trade.

According to the *Board of Trade Journal*, the value of "Conductors, apparatus and other electro-technical materials" into Poland during November last was 9,665,000 zloty (£223,000 approx.), while exports of this class had a value of 300,000 zl. (£7,000).

The Electrical Trade Protection Association.

A meeting of electrical manufacturers and wholesalers was held last week at the Electrical Club, Quebec House, Leeds, Mr. J. Campbell (Milne & Needham, Ltd.), presiding. The chairman introduced Mr. H. C. McMillan, secretary of the British Electrical Trade Protection Association, and said that the meeting had been called in order that the objects and aims of the Association could be fully explained. Mr. McMillan, after describing the various activities of the Association, said that local secretaries had been appointed for each area of England, and that Messrs. Wardale & Co., Town Hall Chambers, Leeds, represented the counties of Yorkshire, Durham, and Northumberland, and would carry out the objects of the Association for the benefit of the members. Mr. Wardale, in endorsing the remarks of Mr. McMillan, stated that it was hoped, in order to reduce the possibility of bad debts, &c., to institute in his area additional means of protection which were discussed. He also stated that monthly meetings would be held in Leeds for the revision of the lists of the Association.

Great Britain's Radio Exports.

From a table published by the *Wireless & Gramophone Trader* it is seen that the total value of exports of radio apparatus from this country during November last was £103,114 (including valves valued at £21,650). The principal customer was Holland, whose share amounted to £11,421 (valves £126), while the Irish Free State was a close second with £11,214 (valves £2,935). Other countries which imported large quantities of British radio apparatus were India and Burma, £8,064 (valves £888); Italy, £7,090 (valves £342); Australia, £6,794 (valves £2,649); Poland, £5,504 (valves £2,409); Belgium, £4,960 (valves £2,072); South Africa, £4,900 (valves £1,401); and France, £4,599 (valves £1,603).

Fire Escape Apparatus.

A device by which occupants of upper floors may escape in case of fire, has recently been produced by Messrs. J. Blakeborough & Sons, Ltd. The appliance consists of an outer fireproof metal case containing 100 ft. of steel cable, fitted with straps to enable one end to be fastened to a projection on the burning building. The cable is unwound at a constant speed and is controlled by the person escaping.

Social Events.

At the recent annual dinner of the staff of Messrs. Francis Polden and Co., Ltd., at Anderton's Hotel, the toast of the chairman and the company was proposed by Mr. J. E. Lamport, who referred to the company's progress. Mr. Polden responded. During the evening the guests were entertained by an excellent concert by the Merrie Villagers Trio, and a dance followed.

The students of the Brush Electrical Engineering Co., Ltd., held their annual supper-dance at the King's Head Hotel, Loughborough, on January 17th. A large company, amongst whom was Mr. Emile Garcke, the chairman of the Brush Company, spent a very enjoyable evening. At supper a message of regret at his inability to attend was received from Mr. W. Johnstone, the managing director.

A very enjoyable carnival supper-dance was held on January 24th, when the directors and staff of the Lancashire Dynamo & Motor Co., Ltd., met with their friends, at Longford Hall, Stretford. Over two hundred sat down to supper, and the proceedings were enlivened by streamers, balloons, &c. During the evening the guests enjoyed songs by Miss Ordish and Mr. Rochester, whilst humorous items by Mr. R. Robson were much appreciated. In the early hours of the morning, a fleet of motor-coaches conveyed the guests to their various destinations.

The fourth annual sports of the Indian Cable Co., Ltd., were held on the company's recreation grounds, Tatanagar, B.N. Railway, India, on January 11th. All employés attended and a large number competed for the 67 prizes and the silver championship cup presented by Mr. F. W. Leake (chairman of directors). The events consisted of the usual track and field events supplemented by humorous events. The prizes and championship cup (won by M. L. Ghosal) were presented to the winners by Mrs. E. D. Johnson. A pleasing feature of the meeting was the enthusiasm shown by the Indians for games and sports generally.

The second annual dinner of the Hastings Corporation Electricity Department Social Club was held at the Queen's Hotel on January 31st. Councillor G. Payne, chairman of the Electricity Committee and president of the club, presided, and those present included Mr. A. J. Ryan, borough electrical engineer, and Mrs. Ryan, Mr. J. Savage, deputy electrical engineer, Mr. J. K. Brydges, Eastbourne borough electrical engineer, Mr. Frost, Bexhill-on-Sea electrical engineer, and borough officials.

Calendar.

A neat desk calendar with monthly slips has been received from A. J. DALTON ELECTRICAL SERVICES, Damers Road, Dorchester.

The Economic Council.

In the House of Commons, on January 22nd, the Prime Minister announced the Government's intention to set up an Economic Advisory Council to assist it in dealing with economic affairs. Last week details of the proposals were issued as a White Paper. The chairman of the Council will be the Prime Minister, and the members will include the Chancellor of the Exchequer, the Lord Privy Seal, the President of the Board of Trade, the Minister of Agriculture and Fisheries, other ministers called in by the Prime Minister and "such other persons chosen by the Prime Minister in view of their special knowledge and experience in industry and economics." The Council will take over and expand the functions of the Committee of Civil Research, and will make a continuous study of developments in trade and industry, and in the use of national and Imperial resources, and all other matters bearing upon the country's prosperity. The Secretary of the Committee will be Mr. T. Jones, C.H., Deputy-Secretary of the Cabinet, and the offices will be at 2, Whitehall Gardens, S.W.1.

Electrical Engineering in 1929.

Included in the tables showing the economic position of the United Kingdom in 1929, published in the *Board of Trade Journal* for January 30th, is the B.E.A.M.A. index of production. With 1924 as a basis of comparison (100) it is shown that the index for last year was 107.0 as compared with 89.8 in 1928.

Wages in the Electrical Contracting Industry.

The National Federated Electrical Association announces that increased rates of pay for men engaged in the electrical contracting industry will come into force on the second pay-day in February for the period covered by that pay-day. The new rates are as follows:—Grade A, 1s. 11d. per hour (¾d. increase); Grade B, 1s. 7¾d. (¾d. increase); Grade C, 1s. 6¼d. (¼d. increase); and Grade D, 1s. 4¾d. (¼d. increase). The Grade A rate includes the increase of 5 per cent. which came into operation in May last and remains in force until further notice.

Electrical Machinery for Bolivia.

The Department of Overseas Trade informs us that the British Consul at La Paz, Bolivia, reports that a local inquirer is desirous of receiving from British manufacturers particulars relating to, and quotations for, electric brick kiln machinery. Firms desirous of offering plant of British manufacture can obtain further particulars from the Department at 35, Old Queen Street, S.W. Reference A.X. 9082 should be quoted.

The Kolster Radio Receivership.

The New York correspondent of the *Financial Times* states that Mr. Rudolph Spreckels, the chairman of Kolster Radio, testifying with regard to the receivership, said he hoped to effect a reorganisation to protect all interests. He said that at one time he owned 387,000 shares of Kolster common stock, but began selling them in the autumn of 1927 to raise funds for a Federal Sugar Refining Company deal. He now owns, he said, 18,000 shares of common and 57,000 shares of preferred stock. He admitted on cross-examination the sale in the autumn of 1928 of 258,000 shares of common stock at $80 which cost between $10 and $22. He also admitted making $500,000 jointly with the Kolster vice-president in underwriting and selling preferred stock.

The Holophane Co.'s New Extension.

Owing to continued progress and the increased ouput of its products, Holophane, Ltd., has added another storey to its works at Elverton Street, Vincent Square, S.W. The company, which was established over 30 years ago, has occupied the present building for eight years. The accompanying illustration shows the works, with the additional storey completed.

The Holophane Co.'s London Works.

Bankruptcy Proceedings.

D. W. MORPHY, manufacturer of wireless apparatus, 14, Colinette Road, Putney, S.W.—The debtor petitioned the London Bankruptcy Court on January 15th and the first meeting of creditors was held last week, when a statement of affairs was submitted showing liabilities of £3,352 against assets valued at £414. According to the debtor's statements in preliminary examination, having served his apprenticeship as an electrical engineer, he obtained an appointment in 1921 with an electrical company, and in 1924 was made works manager for a radio company; he was subsequently elected a director and acted in that capacity until the company went into liquidation in 1928. In May of that year he and a partner started business as manufacturers of wireless apparatus under the style of the Royal Radio Co., each partner providing £50 as capital; the partnership was dissolved in the following December, the debtor paying £300 to the retiring partner and taking over the business. The failure was attributed to lack of capital, bad trade, difficulties in manufacturing, rapid changes in the nature of the demand for wireless sets, and to uncertainty with regard to patents. The estate was left in the hands of the Official Receiver. The following are the principal creditors:—

	£		£
B. A. Bagnall	73	Edison Swan Electric Co., Ltd.	159
Barrow, Hepburn & Gale, Ltd.	157	General Electric Co., Ltd.	118
Carrington Mfg. Co., Ltd.	78	Marconi's Wireless Telegraph Co., Ltd., ...	267
A. C. Cossor, Ltd. ...	230	Parr's Advertising, Ltd.	74
Danipad Rubber Co., Ltd.	99	Wilkins & Wright, Ltd.	66
A. Morphy ...	1,450		

J. P. HAYES, trading as "Evening World Gram. Stores and Service," 17, Lawrence Hill, Bristol, radio electrician.—The first meeting of creditors was held on January 24th at the Official Receiver's offices, Bristol. According to the statement of affairs there were liabilities amounting to £534, and a deficiency of £221. Debtor attributed his failure to his services as representative of a radio firm being dispensed with; want of capital on beginning a retail business in September last; and pressure by creditors. He commenced business on his own account in September last with a cash capital of between £35 and £40. The case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate. The public examination was held on January 31st at the Guildhall, Bristol, when the debtor was ordered to furnish more detailed accounts of the goods which he received as agent for a firm for which he previously worked, and the manner in which he disposed of them, and the hearing was accordingly adjourned.

W. WORSNIP, wireless dealer, 36, Market Hall, Walham Green, S.W.—An application was made on January 28th to Mr. Registrar Mellor in the London Bankruptcy Court for an order of discharge on behalf of this bankrupt, who failed in July, 1928, with liabilities of £427 and assets of £4. The failure was attributed to bad trade, and lack of capital. The discharge was suspended for one year on statutory grounds.

T. E. JONES (B. Jones), electrical engineer, 138, Northgate Street, Chester.—Last day for proofs for dividend, February 17th. Trustee: Mr. W. F. Small, 5, Hunter Street, Chester.

H. PEOVER, electrical apparatus and tool merchant, Market Lane, Newcastle-on-Tyne.—Last day for proofs for dividend, February 15th. Trustee: Mr. R. K. Clark, Official Receiver, 81, St. Mary's Place, Newcastle-on-Tyne.

J. DEAN, electrician, late of 4, Gogerddan Place, Aberystwyth.—First and final dividend of 3s. 8d. in the £, payable at 4, Queen Street, Carmarthen.

A. E. HUMPHREYS, electrical engineer, 20, St. James' Square, S.W.—Trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C., released November 15th, 1929.

T. E. WOODHEAD, electrical factor, 26, Central Drive, Blackpool.—First and final dividend of 5s. 5d. in the £ payable at the Official Receiver's offices, 9, Cannon Street, Preston.

Company Liquidations.

OXFORD WIRELESS TELEPHONY CO., LTD.—A meeting of members is called for March 5th at the office of the liquidator, Mr. E. R. White, 55, Cornmarket Street, Oxford, to hear an account of the winding up.

CECIL HODGES & CO., LTD.—Last day for proofs for dividend, February 11th. Liquidator, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C.

Private Arrangements.

E. C. BEMAN, trading as the Newman Electrical Company, dealer in electrical goods, 5 and 6, Eden Street, Hampstead Road, N.W.—A conference of the principal creditors was held recently when a statement of affairs was submitted which had been prepared by Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., showing ranking liabilities of £5,305 and net assets of £4,710, leaving a deficiency of £595. The debtor was for several years in business, but in 1921 he took over the management of another concern. Later he recommenced trading on his own account. Small profits had been made, but there was a lack of working capital. During the last two years trading had been more difficult, and the debtor had been further hampered recently by the non-delivery of certain goods. The debtor submitted an offer of 13s. 4d. in the £, payable as to 6s. 8d. in three months and 6s. 8d. in six months. It was decided that the matter should be left to a committee consisting of the representatives of the five principal creditors. A circular has been issued to the creditors by Messrs. Corfield & Cripwell, stating that the committee recommends that the offer should be accepted. It is stated that there is every prospect that Mr. Beman will be able to continue and gradually resuscitate the business. The committee also decided that a deed of composition and assignment should be executed in favour of Mr. W. A. J. Osborne and Mr. B. G. Arthur.

The following are the principal creditors:—

	£		£
Central Cables & Accessories, Ltd.	113	Ludenscheider Metall-Werke	405
Compagnie Générale d'Electricité	173	Magnesia-Werke	114
F. Dorschelm	120	Otto Muller	123
Grothe & Sohne	130	Nordböhmische Holzwaren Industrie	55
Gessler & Schriever ...	94	Richter Paul	94
Hochkopper & Co. ...	120	C. Schniewindt	54
Kragelok, Theo & Co.	500	C. F. Schlothauer & Co.	1,612
L'Electro - Construction	82	Schmitz & Co.	70
L'Appareillage Elec. de la Seine	216	Josef Winter & Co	..70

Dissolutions of Partnership.

STATION ROAD GARAGE & ORCHESTRON RADIO MANUFACTURING CO., wireless and motor engineers, Station Road Garage, Warminster, Wilts.—Mr. A. G. Jefferies and Mr. R. Chapman have dissolved partnership. Mr. Chapman will attend to debts and continue the business.

CASSE & WALKER, electricians, 2, St. Jude's Place, Bradford.—Mr. H. H. Cassé and Mr. N. Walker have dissolved partnership. Mr. Walker will attend to debts and will continue business on his own account at 2, St. Jude's Place. Mr. Cassé will carry on business on his own account at 29, Chapel Street, Bradford.

ROSSALL-CANTY RADIO CO., radio engineers, manufacturers and distributors, 28, Paradise Street, Liverpool.—Mr. M. J. Canty and Mr. T. R. Rossall have dissolved partnership. Mr. Canty will attend to debts, and Mr. Rossall will continue the business.

Taunton and Electrical Contractors.

The Taunton Electricity Committee has decided to place the work in connection with its assisted wiring scheme only in the hands of registered contractors, or members of the Electrical Contractors' Association.

Hull and German Cables.

At its meeting on January 29th, the Hull Telephones Committee recommended for acceptance a number of tenders for cable and apparatus. Among them was one from Siemens-Schuckert, Ltd., for cable of German manufacture. It was stated that the price was £1,965, while the nearest British tender was £2,549. A member objected to the acceptance of the tender when there was so much unemployment in this country, but another councillor said that they were willing to give preference to British manufacturers if the margin was not too great, as it was in this case.

Aldershot Company's New Showrooms.

The new showrooms of the Aldershot Gas, Water & District Lighting Co., at Haslemere, were recently formally inaugurated by Mrs. R. W. Edwards, wife of the chairman and managing director of the company.

The Turkish Telephone Concession.

According to a German report from Constantinople, the Turkish Government has withdrawn from the National Assembly the concession agreement between the Government and the Swedish Ericsson Company with regard to the establishment of an inter-urban telephone network in Turkey. It is assumed that the contract, which proposes a concession for 40 years, will be re-examined. The share capital of the company to be formed was to amount to £T2,000,000, of which the Government was to subscribe one half, while the company was to have raised the other and constructional funds amounting to £T3,000,000. After the conclusion of the preliminary agreement with the Ericsson Company last October, the Siemens and Halske Company made an offer to establish telephone connection between the more important cities, but only as constructing contractors, in connection with which credit facilities were held in prospect. At that time, according to the report, the Government seemed to prefer to deal with the matter by way of the grant of a concession. In the event of the revision of the contract now taking place, it is stated that fresh prospects would be opened up for competition from German quarters, as also from the Ericsson Company which might alter its proposals, and perhaps from Italian firms. It is said to be possible that the Government may decide to carry out the telephone installations itself.

The Provincial Electric Supply Association.

At the annual meeting of this Association on January 28th, Mr. K. A. Scott Moncrieff, presiding in the unavoidable absence of Sir Harry Renwick (chairman), read the speech prepared by the chairman in which he dealt with questions arising from Parliamentary matters affecting the electrical industry and to the activities of the Association in connection with the various schemes adopted by the Central Electricity Board. He referred to the operation of the Rating and Valuation Act, 1925, and the heavy increases in assessments experienced by all electricity supply companies. After dealing with a large number of other important matters concerning the electricity supply industry, Sir Harry dealt with the many services rendered by the Association to its members, and the advantages accruing from having a central executive body in London. The Association had admitted to membership during the past year ten other companies, and it could now be said to represent practically the whole of the electric lighting companies in the country outside London. He expressed the view that the industry could not go too far in advertising its commodity and in educating the public to its value and its advantages. Paying a tribute to the Ministry of Transport, the Electricity Commissioners and the Central Electricity Board, he said that it was not only the aim but the duty of the Association to give to those authorities support and co-operation in their very difficult duties. The balance-sheets and accounts for the years ended December 31st, 1927 and 1928, were adopted.

A Report on Colombia.

A great deal of useful information relating to the Republic of Colombia is contained in a "Commercial Review and Handbook" prepared for the Department of Overseas Trade by Mr. J. Garnett Lomax, M.B.E., Vice-Consul at Bogotá. In this it is shown that Colombia is the third in importance among the Republics of South America and in volume of foreign trade she occupied fourth place in 1927, having been seventh in 1917. The handbook deals very thoroughly with the topography, government, trade, industry, &c., of the republic. It is stated that in relation to the needs of the country hydro-electric power is plentiful and well distributed. The power is not cheap but improvement may result from the activities of a foreign group representing "a vast sum of capital," which is gradually acquiring control of municipal light and power plants. The centralisation of management and provision of standardised modern equipment should reduce the cost of operation. The largest plant in the country is that under construction for the municipality of Medellin; the power of 9,000 kW is derived from the local falls of Guadalupe and the general design of the installation will permit of an increase of power up to 30,000 kW. In Cali, Manizales and Bogotá schemes are under consideration for the extension of the existing light and power utilities. In almost every town, even the smaller ones, there is usually an electric light plant; frequently there are several, for the most part under private ownership. Three-phase, 60-cycle supply is almost universal.

P.O. Men's Wages Increase.

Last week it was announced that an upward revision in the scale of wages paid to men employed in the Post Office Engineering Department had been made and the scope of Class I (skilled workmen) had been extended. The wages of the establishment staffs of submarine cable ships have also been increased.

Ironmongers as Electrical Dealers.

At a recent meeting of the West Yorkshire Branch of the Ironmongers' Federated Association at Leeds, Mr. W. Astley gave a lecture on "Electricity in its Relation to the Ironmonger." The speaker, referring to the rapid progress of electricity, said that the ironmonger must be prepared to deal more and more with domestic and general electrical appliances, if not actually with heavier industrial equipment. Already electricity was paramount in lighting and was supplanting steam, gas, and the open fire for heating and cooking. The efficiency of the coal fire was extremely low, whereas in most applications electricity gave practically 100 per cent. efficiency. Electricity was by no means so expensive as many people thought; it was often the means of substantial saving. Mr. Astley instanced a case within his own knowledge of a Leeds cinema which replaced a hot-water installation by electric heating. With electricity at ½d. per unit there was a saving of £480 on initial outlay and £275 in annual running costs. If the price had been ¾d. per unit there would still have been an annual saving of £31 per annum. One advantage of the electrical system was that it was controlled thermostatically and by a time switch. The speaker went on to say that the average price of electricity for heating and cooking in this country was materially lower than in many of the principal areas of the United States. In most areas now electricity was cheap enough to be used in the homes of the working classes for all household purposes. Answering questions, Mr. Astley said that while no doubt the electrical contractor would prefer the ironmonger to leave the business alone, he claimed that the ironmonger was the original seller of domestic electrical equipment and had allowed the trade to slip out of his hands. He was convinced that in 10 years' time the open coal fire would have been superseded by thermostatically controlled electrical systems. He also uttered a warning against the sale of cheap and unreliable electric lamps.

Employé Stockholders in an American Company.

The International Paper and Power Company is making an offering of its cumulative 7 per cent. preferred stock to its own employés and those of subsidiary and affiliated companies at $80 a share. This is the fifth annual stock offering. In the past four years about 37,000 shares have been taken up by employés. The applicants may pay for their stock in full or by instalments, as they prefer, the plan being designed to make it possible for all employés to become stockholders. The number of shares which employés may buy is based on their pay: three shares if their pay is $30 a week or less, four shares if it is $40 a week or less but more than $30 a week, and so on. In addition to the regular 7 per cent. dividends on the stock, the company pays a bonus each year if the subscriber is still working for the company and still owns his stock.

New Italian Companies.

Among the companies recently formed in Italy are the Società Elettrica Valdostana, Turin, capital 100,000 lire; La Società Accumulatori Leggieri Pouchain, Turin, 550,000 lire; and La Società Elettrica dell'Irno, Naples, 500,000 lire.

New Belgian Company.

A company has been formed in Brussels, with a capital of 350,000,000 fr., and the title La Société Electrorails (Compagnies Réunies d'Electricité et des Transports), to acquire and amalgamate the undertakings of the Compagnie Générale de Railways et Electricité, La Compagnie Belge des Chemins de Fer Réunis, and La Federation d'Entreprises de Transports et d'Electricité.

American Activities in Brazil.

Announcement is made of the acquisition of the electric lighting, power and tramway services of Bello Horizonte, capital of the State of Minas Geraes, Brazil, by the Companhia Forza e Luz de Minas Geraes—a new company organised by the Sociedad Empresa Electricas Brasileiras, which is associated with the Electric Bond and Share Co., of New York. The electrical utility services of Bello Horizonte, almost from the foundation of the city about thirty years ago, were organised

by the Government, which has since financed and administered the services except for a short period. It is stated that the new company will retain the Brazilian personnel of the State Department of Electricity, which now becomes extinct. The company intends to carry out a programme of improvements that will permit it to furnish adequate and efficient electrical and urban transport services.

New Catalogues and Lists.

CROMPTON PARKINSON, LTD., Guiseley, Leeds.—An illustrated pamphlet drawing attention to the company's auto-synchronous motors.

UNIVERSAL SYSTEM OF MACHINE MOULDING & MACHINERY CO., LTD., 13-15, Wilson Street, E.C.2.—An illustrated leaflet dealing with a new type of roller conveyor for transporting purposes in works, shops, warehouses, store-rooms, &c.

HART ACCUMULATOR CO., LTD., Stratford, E.15.—A folder dealing with "Hart" wireless accumulators with particular reference to "Rado" high-tension and "RME" low-tension accumulators.

KAY & MORRIS, electrical engineers, 176, North Road, Preston.—Mr. W. B. W. Morris has retired and the business will be continued by Mr. Thomas Kay.

MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Charing Cross Road, W.C.2.—Leaflet No. W.A.25, giving brief particulars of P.M. paper dielectric condensers.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Publication No. S.5116, drawing attention to the "Phonovox" gramophone pick-up.

Messrs. J. H. TUCKER & Co., LTD., King's Road, Tyseley, Birmingham.—A folder outlining the advantages of the company's tumbler switches.

TANGYES, LTD., Birmingham.—A book of blot-sheets, with illustrations of the company's products on the cover.

Messrs. FOX & OFFORD, LTD., Alma Street, Birmingham.—A loose-leaf catalogue containing illustrated particulars of electricity meters, production and stock balance indicators, &c.

WESTON ELECTRICAL INSTRUMENT CO., LTD., 15, Great Saffron Hill, E.C.1.—An illustrated leaflet dealing with a.c. and d.c. portable radio testing instruments.

LANCASHIRE DYNAMO & MOTOR CO., LTD., Trafford Park, Manchester.—List No. 500 containing illustrated particulars of "Crypto-Langham" slow-speed geared motor units.

Messrs. YOUNG & WILDSMITH, 35, Little Russell Street, New Oxford Street, W.C.1.—A comprehensive catalogue (pp. 105), fully illustrated and priced, of wireless material.

Messrs. L. G. HAWKINS & Co., 30-35, Drury Lane, W.C.2.—A number of illustrated publications dealing with the "Universal" vacuum cleaner and heating pad, "Peter the Heater," and "Vio-Ray" artificial sunlight.

24-HOUR SIGNS, LTD., Bredbury, Stockport.—A catalogue, illustrated in colour, of night and day signs; also a leaflet drawing attention to the new "Beam" electric sign.

A. E. G., Berlin.—A well produced brochure dealing with the company's progress during 1929, with some excellent illustrations of its works and products.

SIEMENS-SCHUCKERTWERKE A.G., Berlin.—A well-illustrated publication containing a description of the company's works at Mülheim.

Book Notices.

"The Blue Book Electrical Trades Directory and Hand Book," pp. 1,492. London: Ernest Benn, Ltd. 25s. net. The 48th edition of this Blue Book has been revised and brought up to date. The handbook section has been completely recast and rearranged, to facilitate reference, but otherwise the arrangement of the directory is the same as that of the preceding edition.

"Heating and Ventilating by Electricity." Published by Messrs. Young, Osmond & Young, Ltd. Price 3s. 6d. In its 132 pages of well-produced technical literature, this book contains many well-illustrated descriptions of "Unity" systems of heating and ventilation, including "Unity" tubular heating installations.

"Report for the year 1928-29 of the Department of Scientific and Industrial Research." H.M. Stationery Office. Price 3s. 6d. net.

"The Wireless Manual," by Capt. Jack Frost. Second edition. Pp. vii+164; 83 figs. London: Sir Isaac Pitman and Sons, Ltd. Price 5s. net.

"Introduction to Statistical Mechanics for Students of Physics and Physical Chemistry," by J. Rice. Pp. x+333. London: Constable & Co., Ltd. Price 18s. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLIX. January, 1930.

"Faraday House Journal," Vol. XIII, No. 5, Lent Term, 1930.—This issue's articles are mainly of a mathematical nature.

"The Conductivity of Solutions." C. W. Davies. Pp. viii+204; figs. 22. London: Chapman & Hall, Ltd. Price 15s. net.

The British Electrical and Allied Industries Research Association (Incorporated). Ninth Annual Report—October 1st, 1928, to September 30th, 1929. Published by the Association.

Trade Announcements.

With reference to the recent death of Mr. G. H. Baker, it is announced that the business of G. H. BAKER & SON, electrical engineers, 59, Station Road, Bexhill-on-Sea, will be continued by his son, Mr. F. H. Baker.

In view of the recent sales arrangement with the British Thomson-Houston Co., Ltd., the EDISON SWAN ELECTRIC CO., LTD., has found it necessary to augment its organisation in the Liverpool district. The branch office is accordingly being moved, on February 10th, to more commodious premises at 16, South Castle Street, Liverpool (telephone: Royal 5052), where stocks will be held of lamps, wiring accessories, radio apparatus and valves. There will also be a well-equipped showroom in which lighting equipment, refrigerators and radio apparatus will be displayed. The branch will be under the management of Mr. A. S. Wilson, A.M.I.E.E.

On January 27th the works and offices of the RHEOSTATIC CO., LTD., were removed to Farnham Road, Slough. (Telephone: Slough 900).

To meet the expansion of their business in the Newcastle area, the associated firms of the LONDON ELECTRIC WIRE CO. & SMITHS, LTD., FREDERICK SMITH & CO., and the LIVERPOOL ELECTRIC CABLE CO., LTD., announce that their Newcastle branch is removing to more commodious offices and warehouses at 27, Oxford Street on February 8th, and will commence business there on February 10th.

CONSTRUCTORS, LTD., has moved to larger premises in Tyburn Road, Birmingham. (Telephone: Erdington 2234).

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Feb. 4th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5¾d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¾d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£164	...
	Grade II... ... ... ,, ,,	£115	...
	Grade III ... ... ,, ,,	£65	...
c	Brass (rolled metal 2" to 12" basis) per lb.	10¾d.	...
c	,, Tubes (solid drawn) ... ,,	1/0¾ to 1/1	...
c	,, Wire, basis ... ... ,,	10¾d.	...
c	Copper Tubes (solid drawn) ... ,,	1/3	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84 5s.	10/- inc.
d	,, ,, Sheets ... ,,	£148 10s.	...
d	,, ,, Wire Rods ,,	£94 5s.	...
d	,, ,, H.C. Wire per lb.	11⅛d.	⅛d. inc.
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	8¾d.	½d. inc.
i	Iron, Pig (Cleveland No. 3.) ... per ton	72/6	13/6 dec.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£23	...
g	Mercury ... ... per bot.	£23 2s. 6d. to £23 5s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/5½	...
p	,, ,, wire... ... ... ,,	1/6	...
o	Platinum ... ... per oz.	£12 5s.	5/- dec.
d	Silicium Bronze Wire ... ... per lb.	1/2	...
r	Steel, Magnet, in bars ... ... ,,	7¾d.	...
g	Tin, Block (English) ... ... per ton	£177 15s. to £178 5s.	£4 5s. to £4 15s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co. stated in their letter of February 1st that there was again very little change in the lead position last week. There was a glut of prompt lead, while consumption remained very moderate and demand quiet. Prices continue under control, and, so long as producers are willing to warehouse surplus stocks (the amount of which is growing daily), prices can be maintained at the present level.

Lighting and Power Notes.

Australia.—LAUNCESTON (TAS.)—The City Council has received sanction to a loan of £25,000 for electricity supply extension schemes.

Barking.—ELECTRIC COOKER INSTALLATION.—The Urban District Council Electricity Committee has instructed the engineer to obtain from neighbouring authorities particulars as to the conditions and cost appertaining to the installation of electric cookers.

Barrow.—PROPOSED EXTENSION OF SUPPLY AREA.—A special meeting of the Town Council is to be held on February 24th to consider the question of applying to the Electricity Commissioners for a Special Order to extend the area of electricity supply by the inclusion of a number of townships and parishes in Lancashire and Westmorland.

Cheltenham.—MAINS EXTENSION.—The Corporation Electricity Committee has obtained sanction to a loan of £10,000 for mains and services. The Committee is to lay mains, including street lighting cable, to supply the Pilley Lane housing estate at a cost of £948.

Clitheroe.—PUBLIC LIGHTING.—The Town Council has approved the recommendation of the Electricity Sub-Committee urging the Lighting Committee to lay public lighting cables in all streets where feeder cables are to be laid. The Council has passed a resolution that all new streets shall be lighted by electricity.

Continental.—RUSSIA.—The new Krivoi Rog power station, built by the Southern Ore Trust at a cost of about 16,500,000 roubles (£1,650,000) near Vetcherni Kut on the Yekaterinski Railway, has now been officially opened. Two sets, each of 10,000-kW capacity, have already been installed and later a 24,000-kW turbo-generator is to be added. To ensure a good supply of water to the station, a dam has been built on the river Saksagan, together with a reservoir with a capacity of 6,000,000 cu. metres.—*Reuter's Trade Service* (Moscow).

CZECHO-SLOVAKIA.—There are in Czecho-Slovakia 5,697 villages and townships (about 37 per cent. of the total number of 15,423) supplied with electricity. Of these 4,138 are in Bohemia, while Moravia and Silesia account for 1,301, Slovakia for 241 and Carpathian Ruthenia for 17. Of the electrified areas nearly 62 per cent. of those in Bohemia, 77 per cent. in Moravia and Silesia, and 66 per cent. in Slovakia are linked up with public utility power stations, while the remainder are supplied by private power stations. At the present rate of progress practically every town and village in Bohemia, Moravia, and Silesia will, within six years, be supplied with electricity.

FRANCE.—The Société Force et Lumière des Pyrenees of Paris, has recently secured a concession to establish a large hydro-electric station to utilise the power of the Artigues falls on the river Adour-de-Garet, near Artigues, in the Upper Pyrenees.

BULGARIA.—According to a recent report, there were 147 electricity generating stations with a total capacity of 47,528 kW in operation in Bulgaria at the beginning of 1929. Eleven additional stations totalling 35,175 kW were also in course of construction.

SWEDEN.—A further important extension of the transmission system of the Hammarforsen power station belonging to the Kreuger & Toll concern is announced. A transmission line 136 km. in length is to be built from Sundsvall southwards *via* the town of Hudiksvall, to a point near the town of Soederhamn, and from there through-connection with other lines as far south as the Vifors plant near the town of Gaevle —a distance of nearly 300 km. The combined capacity of the so-called Hammarforsen block, consisting of ten interconnected power plants, amounts to 60,000 h.p.

Coventry.—THE LONGFORD STATION.—The City Council has received a report from the electrical engineer that the work in connection with the first section of the Longford generating station has been completed at a cost of £723,673. Towards this a balance of £110,519 has still to be raised, and application is accordingly to be made for sanction to the borrowing of that amount.

Dover.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has received a letter from Mr. J. S. Highfield giving comparative estimates of the future cost of working the electricity undertaking: (*a*) assuming the power station be improved and developed to provide for a maximum load of 2,500 kW, and (*b*) assuming that local generation be stopped and the whole supply be provided in bulk from the grid system. The estimates incorporate new figures prepared by the borough electrical engineer after reconsideration of the cost of changing the frequency and pressure. The letter points out that the Central Electricity Board, after further negotiations, has slightly revised the terms upon which it offers a bulk supply by reducing the "unit" charge from 0.2d. to 0.19d., and reviews the whole situation. Having considered the letter the Committee recommends that terms be arranged with the Central Electricity Board for taking from it the whole of the electricity supply in bulk.

Dundee.—NEW SUB-STATIONS.—The Corporation Electricity Committee recommends the erection of three small static transformer stations, estimated to cost £15,500 inclusive of the necessary e.h.p. and l.p. feeder cables.

Eastbourne.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £7,338 for mains and £4,894 for plant.

Egypt.—ELECTRICITY GENERATION.—In a recent issue of the *Bulletin* of the Association Suisse des Electriciens, Mr. F. J. Rutgers states that a feature of electricity supply in Egypt is the large number of small Diesel-engined plant, ranging in capacity from 100 to 2,000 kW. There are only two large stations in the country: one of 18,000 kW run by Diesel engines in Cairo and a steam-operated station of similar capacity in Alexandria; there is also a 540-kW hydro-electric plant at Fayoum. The total capacity of the electricity plant in Egypt is at present about 77,000 kW. Schemes for the establishment of a large steam-operated station in the River Nile delta, a hydro-electric plant at the Assouan dam, and a large plant at Quatbara are at present under consideration.

Faversham.—ASSISTED WIRING SCHEME.—The Town Council has requested the electrical engineer to draw up for consideration a scheme of assisted wiring. An application is to be made for an extension of the area of supply.

Guildford.—ELECTRICITY SUPPLY.—At a meeting of the Corporation Electricity Committee held recently, the town clerk submitted a letter from the Electricity Commissioners, forwarding a letter from Mr. O. Spillern, with regard to the supply of electricity to the Hammerfield estate at Abinger Hammer, and stating that the Commissioners would be prepared to consider an application from the Corporation for an Order to permit it to supply any specific premises on the estate in question. The borough electrical engineer reported that he was obtaining particulars as to the number of consumers in the locality who would take a supply.

OVERHEAD LINES.—The Committee has decided to erect overhead lines at Shere at a cost of £1,868.

BULK SUPPLY.—The Committee has approved the terms of the Central Electricity Board for a bulk supply from the Corporation.

Harrogate.—YEAR'S WORKING.—We have received from Mr. Neil McLean, borough electrical engineer, a copy of the accounts of the electricity undertaking for the year ended March 31st last. The gross revenue amounted to £68,103, as compared with £63,442 in the preceding year, and the working expenditure (including taxes) was £36,563, as against £30,918, leaving a gross profit of £31,540 (£32,524). After providing for capital and other charges there was a net surplus of £17,344, as compared with £20,873 in 1927-28. The capital expended during the year amounted to £105,480, the principal items being £41,964 for machinery and £43,201 for mains and services. The total now spent on the undertaking stands at £403,877. The electrical energy sold increased from 6,657,125 to 7,698,448 kWh and the maximum demand from 4,090 to 4,194 kW.

Hastings.—RURAL ELECTRIFICATION SCHEME.—The Corporation is spending upwards of £100,000 in connection with its rural electricity supply scheme for an area covering about 250 sq. miles, and embracing Rye, Winchelsea, Battle, Broad Oak, Brede, Waites Farm, Fairlight Cove, Pett, Icklesham, Beckley, Northiam, Sedlescombe, and Westfield. In connection with the supply to Rye, the whole of the public gas lighting of the borough has now been converted to electricity, while at Battle a large number of business premises are now using electricity. The prices of supply are 8d. per kWh flat rate for lighting, and 1½d. per kWh flat rate for heating, cooking and power. Rental wiring systems for small properties are in operation and also installations can be carried out by the Hastings Electricity Department and obtained on a hire or hire-purchase basis. The Corporation has recently passed a further scheme for extensions to more remote districts.

Irlam.—ELECTRICITY SUPPLY SCHEME.—The Urban District Council has an electricity scheme for the district, and new houses in course of erection are being wired in readiness. The Council already owns more than a thousand houses in the district and the majority of the tenants have voted for the introduction of electricity. The source of supply has not yet been decided upon.

Kettering.—UNEMPLOYMENT SCHEMES.—The Urban District Council Lighting Committee has prepared electricity schemes costing £24,646 for submission to the Unemployment Grants Committee. The schemes provide for the laying of additional mains in the residential areas in Kettering, the establishment of an e.h.p. feeder to the north and south ends of the town, and change-over from d.c. to a.c.

Kingston-on-Thames.—MAINS EXTENSIONS.—The Town Council has decided to carry out mains extensions during the next year at a cost not exceeding £10,000, and has applied for sanction to a loan for that amount. A canvass is to be made in the Canbury Avenue district, for prospective consumers.

Lancaster.—ELECTRICITY SUPPLY EXTENSIONS.—The Town Council has approved a scheme for the extension of the electricity supply along the Lune Valley to Brookhouse, and in a southerly direction to Galgate, in addition to electrifying Hest Bank and Styne, and is to apply for sanction to the borrowing of £30,000 in connection therewith.

New Zealand.—HYDRO-ELECTRIC DEVELOPMENT.—According to *The Times Trade & Engineering Supplement*, inspection of the concession granted by the Dominion Government to

the New Zealand Sounds Hydro-Electric Concessions, Ltd., has been made and reported on by Mr. H. P. Gibbs for the American Cyanamid Company, of New York, and Cyanamid Products, Ltd., London. The area investigated is situated in the Southland fjords between Lake Manapouri and Deep Cove, Smith Sound. The Concessions Company obtained its licence in 1926 to harness water powers from water discharging into Smith Sound, estimated to furnish 50,000 h.p.; and to convey the water of Lake Manapouri to Deep Cove by a tunnel approximately 6¼ miles in length, giving power sufficient to generate 250,000 h.p.

Northern Ireland.—DUNGANNON (CO. TYRONE).—An inquiry was held recently in Belfast by Mr. W. D. Scott and Mr. G. E. Power, who were acting as Commissioners, into two applications for public lighting in Dungannon. The applications were on behalf of Dungannon Gas Company and Electrical Supplies, Ltd., Dromore (Co. Down). On behalf of the electricity company it was stated that the gas company had reduced its prices since the Urban District Council applied in Parliament for an Order to light the town by electricity. The case for both companies was gone into exhaustively, and the result of the inquiry will be announced in due course.

North Wales.—BULK SUPPLY PRICE REDUCTIONS.—The North Wales Power Co., Ltd., has offered substantial reductions in its existing bulk-supply contracts with authorised undertakers subject to their re-selling electricity for cooking and heating purposes to all their consumers at a price not exceeding 1d. per kWh. In notifying the various authorities, the power company expressed the hope that support would be given to the price concessions by the hiring out of cookers, radiators, and water heating apparatus in a combined effort to cultivate this new business.

Shipley.—CHANGE-OVER.—The Urban District Council Electricity Committee has decided to change over the system of supply in the Thackley and Moorhead districts from d.c. to a.c., at a cost of £3,500. The Committee has also had under consideration the question of expediting the change-over from d.c. to a.c. in the central area of the town. Instructions have been given for a preliminary scheme to be prepared and submitted in draft to the Electricity Commissioners and the Unemployment Grants Committee, with a view to ascertaining whether a grant towards the cost of the work would be available if the Council decides to proceed with it at once.

South-East Lancashire Electricity Advisory Board.—EXTENSION ORDERS.—The Engineering Advisory Committee has recommended the Board to support the applications for Extension Orders by the Mid-Cheshire Electricity Supply Co., Ltd., in respect of the rural district of Bucklow; and by the Wigan Corporation in respect of the urban districts of Standish-with-Langtree and Upholland and part of the rural district of Wigan.

OPERATING STATISTICS.—For the quarter ended September 30th last, the total energy delivered to the feeders was 222,546,267 kWh, as compared with 212,658,076 kWh for the corresponding quarter of the preceding year, and the cost per kWh was 0.255d., as against 0.2608d.

EXTENSION OF PLANT.—The Committee has recommended the Board to approve the replacement by the Stockport Corporation of the turbine portion of the 12,000-kW turbo-alternator set at the Millgate generating station. The Board has also been recommended to approve the installation of additional boiler plant, estimated to cost £55,000, at the Manchester Corporation's Barton power station.

FRINGE ORDERS.—Applications for Fringe Orders have been made by the Hazel Grove and Bramhall Urban District Council to supply various premises in the parish of Woodford, and the Committee has recommended the Board to support the applications.

The above minutes of the Engineering Advisory Committee have been approved by the Board.

Southend-on-Sea.—LOAN REFUSED.—The Electricity Commissioners have refused the application of the Corporation for sanction to a loan of £66,000 for new plant at its generating station.

Special Orders.—Application has been made for Special Orders by the Urban Electric Supply Co., Ltd., to supply electricity in (*a*) the borough of Stamford, and (*b*) various parishes in the rural districts of Barnack, Easton-on-the-Hill and Ketton; by the Lancashire Electric Power Co., to supply electricity in the urban districts of Lathom and Burscough and Skelmersdale and part of the rural district of Wigan; and by the Whitehaven Corporation to extend its area of supply so as to include the parishes of Preston Quarter and Sandwich and part of the parish of Hensingham in the rural district of Whitehaven.

The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Aldershot Gas, Water & Electric Lighting Co. to supply electricity in parts of the rural districts of Alton, Petersfield, Guildford, Hambledon, Petworth, Horsham, Midhurst, Thakeham and Westhampnett.

Stoke-on-Trent.—BULK SUPPLY.—The Corporation Electricity Committee has decided that, subject to arrangements being made with the Stone Urban District Council to take a bulk supply for distribution in the Rough Close district, and subject to applications being received for a supply to Lightwood and Rough Close, an e.h.p. overhead line shall be provided from the proposed sub-station in Belgrave Road, Longton, to a point close to Rough Close Farm; that the necessary l.p. mains shall be provided, and that applications shall be made for sanction to the borrowing of £3,600, the estimated cost of the proposed works.

LOANS SANCTIONED.—The Committee has received sanction to loans of £2,000 for the supply of electricity to Fegg Hayes; £10,000 for electricity services; £1,540 for the re-laying of distributor mains in Queen Street and Swan Square, Burslem; £1,000 for the extension of mains to Stuart Avenue and Ash Green, Trentham; and £6,412 in connection with the supply to Blurton Road and Heron Cross, Fenton, and the provision of a sub-station in Lichfield Street, Hanley.

Tynemouth.—LOANS.—The Corporation Electricity Committee is applying for sanction to loans of £15,000 for further installations under the assisted wiring scheme, £5,000 for pre-payment meters, and £5,000 for general extensions.

Walthamstow.—UNEMPLOYMENT SCHEME.—The Town Council has adopted a scheme in connection with the relief of unemployment for laying cables in all roads where an electricity supply is not available, at an estimated cost of £134,867. Sanction to borrow this sum is to be applied for, together with a grant from the Unemployment Grants Committee.

Welwyn Garden City.—NEW INDUSTRIAL ELECTRICITY CHARGES.—The Welwyn Garden City Electricity Supply Co., Ltd., has announced the following new tariffs for the supply of electricity for industrial and commercial consumers:—Industrial maximum demand rate (for consumers having a maximum demand of 5 kVA and upwards) (*a*) for power and heating: A fixed charge of 25s. per kVA per quarter plus a "unit" charge varying from 0.5d. to 0.35d.; (*b*) for lighting and heating: Either a flat rate of 4d. per kWh or a fixed charge of £6 10s. per annum per kW of maximum demand plus 2d. per kWh consumed. Industrial "unit" rate (*a*) for power and heating: First 1,200 kWh per quarter 2d. per kWh, above 1,200 kWh 1d.; (*b*) for lighting: First 100 kWh per quarter in winter and 25 kWh in summer per kW of lighting installed 6d. per kWh; all energy in excess of this amount 3d. There are special charges for limited hour and commercial consumers.

Tramway and Railway Notes.

Australia.—FREMANTLE.—The report of the Municipal Tramways and Electric Lighting Board on the working of the tramway and electricity undertakings for the year ended August 31st last, records a total revenue of £138,805 (£56,079 of which was from the trams) and a working expenditure of £111,674, leaving a gross profit of £27,131. The figures for the preceding year were: Income, £137,989 (£56,729 from the trams); working expenses, £110,792; gross profit, £27,197. From the gross profit the following amounts had to be provided for:—£7,725, interest on loans; £3,690, sinking fund; £572, loan redemptions, and £11,448, depreciation. There remained a net surplus of £3,696, as compared with £3,733 in 1927-28. The number of passengers carried on the tramways increased from 6,082,611 to 6,272,870, while the car mileage rose from 584,802 to 633,863.

Bradford.—RELAYING OF TRACK.—Proposals, involving an estimated expenditure of £16,800 on the relaying of tram lines, chiefly in the centre of the city, have been agreed to by the Finance Estimates Sub-Committee.

Continental.—SWEDEN.—The experience with the electrification a few years ago of the Government-owned railway between Stockholm and Gothenburg (458 km.) has been so favourable that the Railway Board is now submitting a preliminary plan to the Government for the electrification of the chief main line for communication with the Continent, the Stockholm-Malmoe-Traelleborg line (631 km.) and certain junction lines, chiefly those connecting the Stockholm-Malmoe with the Stockholm-Gothenburg line. Forty-eight km. of the Stockholm-Traelleborg line are already electrified as they are common to the Malmoe and the Gothenburg main lines. In all, 856 km. would thus be electrified, and if the plan were accepted in principle, the question could be definitely dealt with by the next Riksdag, and construction work could begin in July, 1931. The main lines would then be opened for exclusively electric traffic in the course of 1934. Electrical power requirements would be entirely assured by the Government-owned power stations and Sydsvenska Kraftaktiebolaget. The total net cost of construction is estimated at Kr. 55,440,000. The Railway Board calculates that against an annual cost of Kr. 5,739,000 due to electrification, there would be a direct saving of Kr. 6,244,000, and an indirect saving of about Kr. 1,000,000.—*Reuter's Trade Service* (Stockholm).

BELGIUM.—Work has been commenced recently by the Société Nationale des Chemins de Fer Vicinaux on the electrification of its system of local railways in Flanders. The lines concentrating on the town of Ghent are the first to be electrified.

Darlington.—RAILLESS CARS.—The 'bus service between the town and Geneva Road West is to be replaced by railless cars, and work on the erection of the necessary overhead equipment is in progress.

Leeds.—TRAMCAR HEATING.—A number of the Corporation's trams are to have electric heaters installed, similar to those in use at Glasgow.

The L.M. & S. Railway.—ELECTRIFICATION SCHEME.—Included in a £750,000 scheme of the London, Midland and Scottish Railway for the improvement of its Southend line is the provision of additional lines, which are to be electrified, between Barking and Dagenham.

The L.N.E. Railway.—PROPOSED TUBE TO ILFORD.—According to an official statement issued recently, the London and North-Eastern Railway is considering the development of its suburban traffic in the neighbourhood of Liverpool Street. A scheme for electrification has been prepared, but the company is satisfied that no such scheme will by itself be an adequate solution of the problem. It is accordingly considering the construction of a tube for the conveyance of suburban traffic between Liverpool Street and Ilford, and is in communication with a well-known firm of engineers with a view to the preparation of plans, together with an estimate of the cost of a tube of this description.

The Liverpool Street to Ilford service has long been regarded as one of the most difficult in London. All trains leaving and entering Liverpool Street station have to pass through a "bottle-neck" at Bishopsgate, where the slightest mishap is sufficient to disorganise the whole system. Between Liverpool Street and Ilford on the main line there are six stations—Bethnal Green, Coburn Road, Stratford, Maryland Point, Forest Gate, and Manor Park. It appears probable that the stations on the proposed tube would be at the same points and would communicate with those on the main line. The total length of the proposed line is 7¼ miles and it is estimated that the cost would be in the neighbourhood of £7,500,000. It is understood that the Ministry of Transport is to be approached with regard to the possibility of obtaining financial assistance from the Government.

West Ham.—RAILLESS CARS.—The Corporation has under consideration the institution of a railless-car service between North Woolwich and Canning Town.

Telegraph and Telephone Notes.

Greece.—GERMAN TELEPHONE CONCESSION.—An agreement is expected to be signed this week with the German concern of Siemens and Halske for the installation and operation for a period of thirty-eight years of the telephone system in Athens.

Hull.—TELEPHONE SERVICE.—The Postmaster-General has renewed the municipality's licence to operate a public telephone service, which was due to expire on December 31st, 1932, for a further 30 years. The Corporation pays about £11,000 per annum in royalties to the Post Office. The service is the only one of its kind in Britain, and subscribers in the Hull area, which embraces the neighbouring townships, enjoy the same facilities for trunk calls as are given the State subscribers. An annual payment of £12 covers an unlimited number of calls; for private houses it is £7 10s. A two-party line for business premises costs £9 3s. 4d. per annum (unlimited service), and for private houses £6 10s. Service on a five-party line costs £3 10s. per annum, for 500 calls, and extra calls can be had at the rate of 6s. 8d. per 100.

Iceland.—AUTOMATIC TELEPHONY.—The Department of Telephones has decided to modernise its telephone network and will adopt the Swedish L. M. Ericsson automatic system. The company, through its agents, the Elektrisk Byra, in Oslo, has contracted for the delivery of automatic exchanges primarily for the town of Reykjavik and the adjacent town of Hafnarfjoerd, with a total number of 4,300 subscribers. Communication between the two towns, situated about 10 kilometres from each other, will be entirely automatic, which is a novelty in the technique of inter-urban telephone systems.

Imperial Communication.—CONTROVERSY.—The Government is reported to be studying the controversy which has resulted from allegations of lack of co-operation between the Post Office and Imperial and International Communications, Ltd., and failure to carry out the intentions of the Imperial Cable and Wireless Conference, particularly with respect to the development of short-wave beam telephony within the Empire.

The Telegraph Service.—DEFICIT.—The Post Office commercial accounts for the financial year ended March, 1929, show that the deficit of the service was £757,237 during the year, as against £1,380,829 in 1927-28, being the smallest for nine years. The percentage of operating expenditure of total income was 114.76 per cent., as against 127.56 per cent. in 1927-28.

The Telephone Service.—SURPLUS.—The Post Office commercial accounts for the financial year ended March, 1929, show that the surplus of the service was £524,695, as against £107,391 in 1927-28. The percentage of operating expenditure of total income was 75.6 per cent., against 77.74 per cent. in 1927-28. The income increased to £20,329,077, compared with £18,874,816 in 1927-28, but the expenditure, including interest on capital, grew by £1,036,957, the chief increase being £528,639 for provision against depreciation and £341,040 for interest on capital.

Transatlantic Telephony.—DEVELOPMENTS.—The transatlantic wireless telephone receiving station at Kemback, Cupar (Fife) is now serving the whole of Europe and America and so numerous have the calls become that the station is working throughout the 24 hours of each day. It has been found necessary to increase the present facilities, and negotiations have been entered into with the land proprietors adjoining Kemback for wayleaves. It is proposed in the meantime to install another receiving set, which will be worked from the present station, but if, as seems likely, still further extensions are required, a larger station may be considered.

The American Telegraph and Telephone Company announces that a wireless-telephone service between New York and Warsaw was opened on February 1st.—*Reuter's* (New York).

CABLE COST.—Plans for laying a transatlantic telephone cable were disclosed by Mr. Walter S. Gifford, president of the American Telephone and Telegraph Co., to the U.S. Senate Inter-State Commerce Committee this week, when he said the cable, which would be ready for use in 1931, would cost between £2,000,000 and £3,000,000. It was a move on the part of American interests to offset a possible British world monopoly of means of communication.

Radio Notes.

B.B.C. Income.—P.O. ACCOUNTS.—The Post Office Commercial Accounts for the financial year ended March, 1929, show that the cash receipts for wireless receiving licences totalled £1,358,187. The 12½ per cent. credited to the Post Office for expenses of management and other costs absorbed £178,686, leaving a balance of £1,179,501. The sum paid to the British Broadcasting Corporation was £887,616, leaving a balance accruing to the Exchequer of £291,885, an increase of £47,000 during the year.

Denmark.—LICENCES.—The number of licences taken out during the past month was 13,729, while the total number at the end of December, 1929, reached 308,927, or 8.79 per cent. of the population. At the end of December, 1928, the corresponding figures were 252,700 licences and 7.19 per cent. Included in the figures are the licences issued free to the blind, cripples, and persons suffering from chronic diseases, which, at the end of December, 1929, amounted to 5,328. Doubtless the great increase in December, *World-Radio* explains, was in consequence of the reduction in fees for licences taken out during the period from December 15th, 1929, to March 31st, 1930, to 5 kroner (about 5s. 6d.) for the remainder of the financial year.

France.—TOURISTS' RECEIVING SETS. — The Automobile Association has been officially informed that tourists may take wireless sets to France, either mounted on motor-cars or in their personal luggage, but duties and taxes must be paid; no refund will be granted on re-exportation. The Customs duty on British sets (minimum tariff) is 22 per cent. *ad valorem*. In addition, there is a luxury tax on sets valued at more than 700 francs and on loud-speakers valued at more than 200 francs. The visitor must purchase a licence at a French post office before using his set.

India.—SERVICE CESSATION.—The Indian Broadcasting Company has issued a statement that it will discontinue operations at the end of February, as it has hitherto lost over £37,000 in excess of its income, and in addition to capital laid out on plant. As the money, the statement adds, has been borrowed, no further funds are available, and no borrowing is possible. Expenditure has exceeded income by £15,000 annually. The company appealed to the Government for help, which was refused.—*Reuter's* (Bombay).

Portugal.—MONOPOLY.—A few days ago a draft decree was published showing that Portugal intends making radio-telegraphy, radio-telephony, and broadcasting a State monopoly. The scheme is being vehemently opposed by wireless amateurs, who state that the result would be indifferent without competition. Public opinion appears to want the wireless service to be free, so that anyone would be able to receive and anyone would be able to set up a transmitting station should they wish to do so.—*Reuter's* (Lisbon).

United States.—THE "MONOPHONE."—General George Squier, former Chief Signal Officer of the Army, has explained to the Senate Commerce Committee the desirability of the adoption of the "monophone," his most recent invention. The instrument links wireless with the telephone, and will, he says, keep the telephone wires of the country at work for sixteen hours a day, instead of the present average of eighteen minutes. According to the *Daily Telegraph*, he proposes to employ a frequency above that used by wired radio, and to supply a programme of entertainment from the company's switchboard night and day. He estimates the cost at 8s. a month to telephone subscribers, and regards his plan as a solution of the problem of the congestion in broadcasting.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraph Department. March 11th. Bells and buzzers. (B.X. 6055.)*
March 24th. Dial parts. (B.X. 6047.)* Automatic exchange power boards. (B.X. 6072.)*
March 25th. Cordless switchboards. (B.X. 6071.)*
April 1st. Submarine cable. (B.X. 6070.)*
March 10th. State Electricity Commission of Victoria. Two 6,000-kVA, 3-phase transformers with spare coils and bushings. (B.X. 6014.)*

Basingstoke.—February 8th. Electricity Department. Supply, delivery, and erection of two heavy oil engines, each direct-coupled to one 800-kW, 3-phase, 50-cycle alternator. (January 17th.)

Belfast.—February 11th. Tramways Committee. Supply of tramway stores for twelve months from April 1st, 1930. (January 31st.)

Bexley.—Electricity Department. One 1,400-kVA Scott-connected transformer bank, switchgear, and cables. (See this issue.)

Brentford.—February 26th. Union Guardians. Provision of a central switchboard and the laying of mains at the West Middlesex Hospital, Isleworth. (See this issue.)

Cheadle and Gatley.—February 11th. Electricity Department. Supply and delivery, as required, during the twelve months ending March 31st, 1931, of cables, lamps, meters, street lighting standards, electrical fittings, &c. (January 17th.)

Hull.—February 20th. Electricity Department. Supply and erection of one water-cooling tower and two motor-driven vertical spindle drainage pumps, and supply and laying of cast-iron circulating water pipes. (January 31st.)

Kettering.—February 10th. Electricity Department. Supply and delivery of high and l.p. cables. (January 31st.)

Leeds.—February 18th. Electricity Department. Supply of stores during the year ending March 31st, 1931. (January 31st.)

London.—CENTRAL ELECTRICITY BOARD.—February 22nd. Supply, delivery, and erection of transformer oil treating plant for 18 transformer stations in the Central England Electricity Scheme. (January 31st.)
March 3rd. Construction of site works, foundation works, and buildings in the area of the South-East England Electricity Scheme. (See this issue.)
HAMMERSMITH.—February 26th. Borough Council. Stores (including electric lighting sundries, cables, joint boxes, &c.) for 12 months. (January 24th.)
METROPOLITAN ASYLUMS BOARD.—February 19th. Installation of electric lighting at Woolwich and Lambeth casual wards, conversion of workshop power units to electricity at Darenth Training College, and installation of wireless receiving apparatus at Northern Hospital. (See this issue.)
BETHNAL GREEN.—February 20th. Borough Council. Electric lighting installations at four blocks of tenement dwellings. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. March 24th. Resistances and reactances. (B.X. 6046.)*
March 5th. V.i.r. wire. (B.X. 6089.)*
April 29th. Public Works Department. One 10,000-kVA synchronous condenser and accessories. (B.X.6084.)* Single-phase transformers and accessories. (B.X. 6035.)*
May 6th. 750-kVA transformers for Arapuni power scheme (B.X. 6095.)*
May 13th. 110-kV transformers for Mangahao power scheme. (B.X. 6096.)*

Northern Ireland.—BELFAST.—February 10th. L.M. and S. Railway. Northern Counties Committee (Ireland). Telegraph ironwork, wire, electric lamps, and porous pots required during 12 months. Form of tender (6d.) from Mr. F. J. Martin, stores superintendent, York Road station, Belfast.

Plymouth.—February 20th. Corporation. Supply of meters, cables (paper insulated), and transformers. (January 31st.)

Portsmouth.—February 10th. Tramways Committee. Supply of goods, including insulating materials, lamps, motor windings, overhead line materials, &c., from April 1st to March 31st, 1931. (January 17th.)

Rugby.—February 10th. Rural District Council. Electric light installation for 74 houses. J. E. Weeks, surveyor, Temple Street.

Salford.—February 8th. Electricity Department. L.p. paper-insulated, lead-covered, and armoured cable. (January 24th.)
February 15th. Board of Guardians. Electric lighting installation for the lodge and new roads, Eccles New Road, Pendleton. Specifications (deposit £2 2s.) from E. H. Inchley, Clerk to Board of Guardians, Poor Law Offices, Eccles New Road, Salford.

South Africa.—JOHANNESBURG.—March 20th. Railways and Harbours. Two 150-kVA motor alternators for Durban. (B.X. 6115.)*

Southend-on-Sea.—March 3rd. Corporation. Supply of general stores for 12 months, commencing April 1st, 1930. (See this issue.)

Stockport.—February 18th. Electricity Department. One 60-ton electric crane and gantry. Specification from R. Lee, borough electrical engineer, Electricity Offices, 23, Tiviot Dale.

Stoke-on-Trent.—February 12th. Electrical Engineer's Department. Electric mains van. (January 17th.) 12 months' supply of mains, cables, and static transformers. (January 24th.)

Sweden.—GOTHENBURG.—March 3rd. Harbour Authority. Ten 2½ metric ton, electrically-operated portal cranes. (A.X. 9089.)*

Torquay.—February 15th. Electricity Department. Supply, delivery, and erection of two water-tube boilers, economisers, air preheaters, induced and forced draught fans, &c. (See this issue.)

Uruguay.—MONTEVIDEO.—February 15th. Posts, Telegraphs and Telephones Administration. 1,771 metric tons of telegraph wire. (A.X. 9047.)*

Wimbledon.—February 17th. Corporation. Supply, delivery, and erection of one 7,500-kW, 2-phase, turbo-alternator, condensing plant and auxiliaries. (January 31st.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Barking.—Urban District Council Electricity Committee. Recommended:—
Supplying and laying of London and Hertford Road feeder and distributor:—

Siemens Bros. & Co., Ltd.	£3,149
Pirelli-General Cable Works, Ltd.	3,200
W. T. Glover & Co., Ltd.	3,216
Enfield Cable Works, Ltd.	3,232
British Insulated Cables, Ltd.	3,244
Johnson & Phillips, Ltd.	3,260
W. T. Henley's Telegraph Works Co., Ltd. ...	3,280
Standard Telephones and Cables, Ltd. ...	3,304
Union Cable Co., Ltd.	3,469
Electricity Department (using A.C.E.C. cable)	2,920
Alternatively (using Siemens cable)	3,208

It is recommended that the work of laying the cable be carried out by the Electricity Department, and that A.C.E.C. cable be used. It is also recommended that the tender of the Ateliers de Constructions Electriques de Charleroi for 6,300 yd. of cable (£1,177) be accepted.

Birkenhead.—Electricity Committee. Accepted:—
1,500-kW convertor equipment at Bentinck Street Station (£3,361).—Mather & Platt, Ltd.
Three 6,600-volt switchgear cubicles (£298).—The New Switchgear Construction Co., Ltd.
E.h.p. metal-clad switchboard at Bentinck Street Station (£10,562).—Metropolitan-Vickers Electrical Co., Ltd.

Brighton.—Lighting Committee.—Correction.—The tender of British Separators, Ltd., which the Committee recently recommended for acceptance, covered a portable oil purifying unit for turbine and insulating oil service, and not an oil heater, as stated in our issue of January 24th.

Glasgow.—Tramways Department.
2,000 "Mazda" traction lamps.—British Thomson-Houston Co., Ltd.

Hull.—Telephones Committee. Accepted :—
Cable : (£1,965 and £129), Siemens-Schuckert, Ltd.; (£312), British Insulated Cables, Ltd.
Nine miles of inside wire.—W. T. Henley's Telegraph Works Co., Ltd.
Switchboards (£217).—Sterling Telephone & Electric Co., Ltd.
One P.B.X. box (£229).—Ericsson Telephones, Ltd.

Ilford.—Electricity Committee. Accepted :—
Transformer kiosk (£257); 100-kVA transformer (£89).—Crompton Parkinson & Co., Ltd.

Leeds.—Tramways Committee. Accepted :—
Cable conduits (£646).—Leeds Fireclay Co., Ltd.
Electricity Committee.
Cables : (£666), Enfield Cable Works, Ltd.; (£1,525), Hackbridge Cable Co., Ltd.; (£1,075), Derby Cables, Ltd.; and (£1,870), Croydon Cable Works, Ltd.

Leicester.—Mental Deficiency Committee. Accepted :—
Electric lighting installation at Frith Institution (£227).—T. H. Wathes & Sons.

London.—ADMIRALTY.
Carbon lamps.—Edison Swan Electric Co., Ltd.
METROPOLITAN ASYLUMS BOARD.—Recommended :—
Additional lighting and power points at Caterham Mental Hospital (£123.)—Read & Partners, I td.
Alterations to electric lighting, South Western Hospital (£130).—Alpha Manufacturing & Electrical Co., Ltd. (accepted).
Replacing electric storage battery, St. Lukes Hospital (£258).—Hart Accumulator Co., Ltd. (accepted).
Installation of electric lighting and telephone in "The Firs," Caterham Mental Hospital :—

L. G. TATE & Co., LTD. (Recommended). ...	£184
W. J. Furse & Co. (London), Ltd.	195
Read & Partners, Ltd.	195
Toy & Winslow	208
Buchanan & Curwen	215
T. Clarke & Co., Ltd.	220
F. Polden & Co., Ltd.	225

LONDON COUNTY COUNCIL.—Education Committee.
Electric wiring and fittings for Kender Street School, Deptford :

L. G. TATE & Co., LTD. (Recommended.) ...	£347
H. J. Cash & Co., Ltd.	356
Pinching & Walton	515
Heath-Pritchard, Ltd.	721

Highways Committee.
Track rails and fish plates for 12 months (£53,897).—Dorman, Long & Co., Ltd.

Newcastle.—Newcastle Electric Supply Co.
11,000 "Mazda" lamps.—British Thomson-Houston Co., Ltd.

Salford.—Watch Committee. Recommended :—
Automatic traffic signals (£144).—Barber & Colman, Ltd.

Stoke-on-Trent.—Estates Committee. Accepted :—
Conversion of electric lift at Hanley Town Hall from d.c. to 3-phase (£144).—Wm. Wadsworth and Sons, Ltd.

West Ham.—Board of Guardians. Accepted :—
Installation of internal telephones at the Children's Homes (£233).—Relay Automatic Telephone Co., Ltd.

York.—Watch Committee. Recommended :—
Traffic signals (£529).—Barber & Colman, Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, February 7th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.30 p.m. "Co-operation between Technical Institutions and Industry." Mr. G. F. O'Riordan.
Saturday, February 8th. Portman Rooms, Baker Street, W. 7.15 p.m. Annual dance.

Electrical Power Engineers' Association.—Tuesday, February 11th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Mechanical Stokers and their Auxiliaries." Mr. A. W. Bennis.

Institution of Railway Signal Engineers.—Wednesday, February 12th. Institution of Electrical Engineers, Victoria Embankment, W.C. 6 p.m. Annual general meeting and presidential address.

Institution of Heating & Ventilating Engineers.—Wednesday, February 12th. Holborn Restaurant, W.C. 2.30 p.m. "Half a Century of Boiler Making." Mr. S. Fox. 7 p.m. Annual dinner.

Optical Society.—Thursday, February 13th. Imperial College of Science, S. Kensington, S.W. 7.30 p.m. Presidential address by Mr. F. Twyman, F.R.S., on "Optics in Radio Transmission and in other Fresh Fields."

Electrical Wholesalers' Federation.—Thursday, February 13th. Savoy Hotel. Annual dinner.

Institution of Electrical Engineers.—Thursday, February 13th. Institution, Victoria Embankment, W.C. 6 p.m. "The Jet Wave Rectifier : the Experimental and Theoretical Bases of its Design." Dr. J. Hartmann.

(North-Eastern Centre).—Monday, February 10th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Recent Developments in the Protection of 3-phase Transmission Lines and Feeders." Messrs. T. W. Ross and H. G. Bell.

(North-Midland Centre).—Tuesday, February 11th. Hotel Metropole, Leeds. 7 p.m. "The Jet-wave Rectifier; The Experimental and Theoretical Basis of its Design." Dr. J. Hartmann.

(Scottish Centre).—Tuesday, February 11th. Royal Technical College, Glasgow. 7.30 p.m. "The Visit of the Institution to France." Mr. W. B. Hird.

(North-Eastern Students' Section).—Friday, February 7th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "The Electrical Propulsion of Ships" Mr. W. G. Thompson.

(North-Western Students' Section).—Tuesday, February 11th. Engineers' Club, Manchester. 7.15 p.m. "The Layout of a Distribution Scheme for a Small Township." Mr. H. Breckell.

(Western Centre).—Monday, February 10th. Cardiff. Ordinary meeting.

(Dundee Sub-Centre).—Thursday, February 13th. University College, Dundee. 7.30 p.m. "Lubrication." Mr. G. H. Chalmers.

(East-Midland Sub-Centre).—Tuesday, February 11th. The College, Loughborough. "Electrical Development." Mr. G. R. J. Parkinson.

Institution of Engineering Inspection.—Friday, February 14th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "Optical Aids to Engineering Inspection." Prof. A. F. C. Pollard.

Physical Society.—Friday, February 14th. Imperial College of Science, South Kensington. 5 p.m. Ordinary meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, February 15th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Safety and Efficiency in Mines." Mr. W. A. Hutchings.

British Industries Fair.—February 17th to 28th. Olympia, London, W., and Castle Bromwich, Birmingham.

Overhead Lines Association.—February 19th. Institution of Electrical Engineers, Savoy Place, London, W.C.2. 5.30 p.m. "Rural Electrification." Mr. W. P. Gauvain.

The Electrification of Pomerania.

Since the reunion of Pomerania with Poland, energetic measures have been taken with a view to achieving the electrification of this maritime area. Municipalities, local district authorites, and provincial government authorities, have participated in this work with excellent results.

The provincial authorities have constructed the Grodek hydro-electric station situated on the River Czarna Woda, and the basic technical scheme scheduled includes the establishment throughout the area of Pomerania of main and secondary hydro-electric works, as well as of provincial transmission lines at 60,000 volts for the purpose of inter-connecting all water and steam generating stations. The main transmission lines will be, or have already been, connected with the most important centres of consumption, *i.e.*, the towns. The district government authorities have the duty imposed upon them of providing cheap and abundant supplies of electricity in bulk, but distribution and retail supplies are left to the towns and district electrification companies. At little expense the large towns have gained as consumers those who had previously owned small electric power stations. In addition unions of several districts have been formed, which have erected distribution lines at 15,000 volts at their own expense, thus connecting smaller towns and country villages.

The Grodek hydro-electric power station supplies several towns with electricity, including the industrial cities of Grudziadz and Torun and the surrounding districts. Owing to the connection of the Grudziadz electric power station with Gdynia, for the supply of electricity to which port a contract has been signed, the construction of a new hydro-electric power station at Zurza has been necessitated. These works of 12,000 h.p. were opened at the end of December, 1929, and considerably increase the plant capacity of the system. They have been constructed exclusively with Polish capital, supplied by local government authorities and by the National Economic Bank, in the form of a long-term credit.

The authorities owning Grodek power station will not restrict its output to the area already electrified; they propose to electrify the whole area of Western Poland and some parts of the Central Counties of Poland.

Notes.

O.L.A. Supper-Dance.

The Overhead Lines Association is holding a conversazione and supper-dance in the Georgian Restaurant of Messrs. Harrods, Ltd., Knightsbridge, London, on Wednesday evening, February 26th. Arrangements for the comfort of non-dancers have been made and there will be an exhibition of overhead-line apparatus and appliances. Tickets (12s. 6d. each, which includes dancing and a 4-course supper, but not wines or buffet refreshment) are obtainable from Mr. W. F. Andrews, 14, Violet Road, London, E.3, and other members of the Social Committee; early application is requested. There will be ample car-parking facilities in the immediate vicinity.

Barton Power Station Fumes.

According to the *Manchester Guardian*, Manchester Corporation has decided to engage three consultants to assist the electrical staff in investigations into the removal of sulphur-oxides from the boiler flue gases. The three engineers who are to assist are Dr. S. L. Pearce, the chief engineer of the London Power Company, Mr. J. H. Rider, of Messrs. Preece, Cardew, and Rider, consulting engineers, and Mr. Melling, of Messrs. Melling & Ardern, consulting chemists. Steps are being taken to provide a fund, with the co-operation of the larger undertakings in the country, from which the expenses of the investigations can be met.

Educational.

At the L.C.C. School of Engineering and Navigation, High Street, Poplar, E.14, a special course of five lectures on the high-voltage transmission and distribution of electrical energy is being delivered on Tuesdays (7 to 9 p.m.) by Mr. E. T. Painton. The course commenced on February 4th.

A course of six lectures on "The Accumulator" will be given by Mr. C. N. Good, A.M.I.E.E., of the Chloride Electrical Storage Co., Ltd., at the Chelsea Polytechnic on Friday evenings (7 p.m.), commencing February 14th. The fee for the course for students residing in the London area is 5s.

Electricity Supply in the West.

Commenting recently upon the Central Electricity Board's scheme for the bulk supply of electricity in South-West England (see ELEC. REV., January 17th, 1930, p. 141), Mr. H. D. Munro, electrical engineer to the Exeter Corporation, pointed out that the area dealt with was by far the largest in extent of any of the schemes initiated by the Electricity Commissioners. The base-load stations affecting the south-western end of the area would be at Portishead (Bristol Corporation), Southampton (Corporation), and Hayle (Cornwall Electric Power Co.), and the three main transmission lines from those stations would converge at Exeter and be linked there. It looked from that as if the Exeter Corporation's works would play a prominent part in the scheme, and the Plymouth, Torquay, and Exeter undertakings would all have parts to play, the stations being used either for generating or transmitting as required by the scheme. The Exeter Corporation undertaking entered recently into a contract to supply electricity in bulk to a company which was to supply a large area in East Devon, and that contract would not be disturbed. Exeter also supplied electricity in bulk to Crediton, and Topsham was also being electrically lighted by the Exeter Corporation, which some time ago purchased the Topsham electricity undertaking. The main transmission lines would be supported on steel towers, and Mr. Munro said he knew that every care was being taken by the Commissioners to ensure that due regard would be paid to the preservation of the scenic amenities of Devonshire. The Commissioners claimed that under the scheme it would be much easier to develop rural areas. The scheme would also help to relieve unemployment, and might result in additional works being established in that part of the country.

Mr. A. R. Howden, manager of the Falmouth electricity works, said he did not know what would happen to them under the scheme, but he could only think that they would be bound to be taken over. A few technical difficulties might have to be overcome by arrangement with town authorities, such as the handling of town refuse. Unless the agreement on that point was rescinded, they would have to go on burning it, but he took it the Electricity Commissioners would have the final say in that sort of thing. At the present moment they were generating electricity and supplying it at a lower price than any other town in Cornwall, and it would have to be settled how they could continue to supply Falmouth at the present price if new people took control. The scheme should do a lot of good towards industrial development and open up districts which were at present dead. The more work a farmer could put into his land the more work he could give his men to do. On the social side, also, the scheme would brighten up the homes of people who were now living by candle-light as it were. Generally speaking, he thought the scheme would spread work all over the country and bring down the cost of living, while the more power that was used the cheaper electricity was bound to become.

Mr. Lovell R. Dunstan, chairman of the Electricity Committee of the Plymouth City Council, stated that it was difficult to understand why Plymouth was not included in the list of selected stations, though he had no doubt that it would be part and parcel of the general system. Application had only recently been made to the Electricity Commissioners for a loan of £106,000 for new plant for the Plymouth station, and there was no reason to doubt that it would be granted. In addition, they were now in negotiation with the Cornwall Electric Power Company to give it a supply in bulk for the area from Torpoint to Callington.

The chairman of the Torquay Corporation Electricity Committee, Mr. F. Callard, said that Torquay had prepared itself for the scheme, and had been permitted to put in another 7,500-kilowatt set at the generating station at Newton Abbot, at a cost of £98,000, which would enable the peak loads to be maintained. With the present demand the undertaking would have been taxed next winter without that new plant. In the scheme the Torquay generating station at Newton Abbot was included among eleven temporary stations, but he found in the details that plant, representing 2,725 kilowatts, had to be written off before 1941, which meant that the Torquay station would continue to operate for at least another eleven years. Should Torquay obtain sanction for its entire scheme of distribution, it would serve an area of 137 square miles with a population of between 150,000 and 200,000, extending from Teignmouth to Ivybridge and including Kingsbridge, Salcombe, and Dartmouth, and on the moorland side right up to Moretonhampstead.

Fatalities.

An inquest was held at Enfield on January 28th on Arthur Frederick Luff, employed at the Blackstock Engineering Works, Enfield Wash. Herbert Mitchell said that on the morning of the accident it was found necessary to remove an electric lamp from one beam to another, and Luff fetched a short ladder which he placed against the beam. He had one foot on a furnace and one on the ladder, and took the lamp and slung it over a beam, after which he collapsed. Evidence was given that the lampholder was defective, and Dr. Hugh Warren expressed the opinion that death was due to electric shock. A formal verdict was returned.

Evidence was given at the Battersea Coroner's Court recently as to the cause of the death of John Gadson, electrician, who received a fatal electric shock at a private house. The occupier stated that deceased was engaged in installing an electric fire in a room and took up some floor boards to do his work. He put his arm under the boards, and when addressed by witness did not reply. A doctor, who was called in, stated that he found Gadson with his right arm in contact with a tube containing a main electric wire. Mr. H. F. J. Thompson, chief assistant electrical engineer to Battersea Borough Council, said he understood that deceased had switched off the heating supply, but not the lighting. Witness uncovered a steel tube and an inspection box, which were found to be "alive," due to defective insulation of the wire, which had perished. A formal verdict was returned.

An inquiry held on January 19th into the death of Arthur Illingworth, of Thackley, by the Bradford Coroner, was adjourned. Mrs. Illingworth stated that she found her husband dead, with the plug of an electric iron in one hand and a pair of scissors in the other, and medical evidence was that death was due to electrc shock. Mr. A. S. R. Pratt, an electrical engineer, said that he found that the positive wire went to the switch and the negative wire to the plug. Part of the wiring of the house was with connections of the same colour instead of two different colours. The deceased had evidently cut through the insulated wire connected to the plug, and received a shock at 240 V. If the wiring was accurate and the iron properly used there was no danger.

The Coal Mines Bill.

In a letter to *The Times*, Mr. Robert Clive, Secretary of the South Yorkshire Coal-owners' Association, refers to a previous communication to that paper by Mr. W. B. Woodhouse, in which it is suggested that the tendency on the part of coal-owners has been to charge higher prices to electricity and gas undertakings than the economic position warrants, and that under the Coal Mines Bill this tendency will be fostered and assisted.

Mr. Clive states that the reverse is the position, as for some years past electricity undertakings and gas companies have obtained supplies of fuel at prices very much lower than the cost of production. He adds that gas and electricity undertakings have paid handsome dividends to their shareholders and the bulk of the collieries have paid no dividends at all and have had to borrow money to make up losses. His view is that the marketing proposals of the Bill are to correct this anomaly and to provide means whereby all consumers will be able to obtain coal at fair and reasonable prices and at prices which will enable the coal industry to live.

Among coal-owners in South Yorkshire the view is strongly held that the existing restrictions placed upon the colliery supply of surplus electricity and coke-oven gas, which almost amount to prohibition, should be removed; inasmuch as collieries are in a position to produce cheap electricity at the pithead from inferior and inexpensive fuel at costs very much lower than that of the average central power station, and vast supplies of surplus coke-oven gas are available at coking plants in South-Yorkshire, many of which are entirely new plants and the last word in coke-oven construction.

Oil Purification.

We are informed by Mr. A. W. Empson, of 46, Christchurch Avenue, Brondesbury, London, N.W.6, that he believes he has solved the problem of eliminating colloidal carbon from the straight hydrocarbon oils used in Diesel and other internal-combustion engines, and in switchgear, &c. This impurity

has hitherto resisted all attempts to separate it by centrifugal force alone, owing to the fact that the particles, being extremely small, are subject to the "Brownian movement" by reason of the electrical charges which they carry. So long as the charges persist, coagulation is impossible; the neutralisation of the charges by means of electrolytes, such as solutions of salts, alkalis, oleic acid, &c., is uncertain and entails the risk of traces of the chemical remaining in the oil, while treatment with Fuller's earth and similar substances results in a loss of oil in the material, both processes requiring time for completion and involving skilled attention. The new process, which is carried out in a specially-designed centrifugal machine, called the "Colloid Coagulator," without the addition of chemicals or earths, neutralises the electrical charge and causes immediate coagulation, after which separation may be effected by gravity settlement, ordinary filtration, or centrifugal treatment. In connection with the last-named it is interesting to note that, owing to the flocculent condition of the coagulated carbon, a large percentage can be continuously discharged from the water spout of the separator by running a small quantity of water in with the treated oil, thus reducing the frequency of stops for cleaning. This result is obtainable from any ordinary centrifugal separator without alteration to the drum or bowl. The process is applicable to an existing separator by arranging for the coagulator to discharge into it direct, or both coagulation and separation can be effected in a single machine of special design.

Appointments Vacant.

Engineer-in-charge, second assistant clerk, inquiries clerk, and junior clerk for Hammersmith Borough Council. Ex-officer for negotiating wayleaves for overhead lines for the Aldershot Gas, Water & District Lighting Co. Works engineer-manager for destructor works, sewage disposal and electrical installation for Reigate Corporation. Electrical (traction) engineer for the Bombay, Baroda, and Central India Railway. Assistant engineer for the Combustion and Testing Department of the Lancashire Electric Power Co. Maintenance engineer for Worcester City Council. Male assistant superintendent of traffic in the London Telephone Service and in the provinces for the Civil Service Commission. Two grade "B" clerks for Leyton Electricity Department. (See our advertisement pages to-day.)

Manchester's Distribution System.

In an interesting discourse at a well-attended meeting of the Manchester Association of Engineers, Mr. H. C. Lamb, chief engineer of the Manchester Corporation Electricity Department, recently referred to many of the variations of adopted practice in the distribution of electrical energy, which, to those not engaged in the industry, were at times very puzzling. Manchester originally favoured the direct-current system, but the lower capital cost of a.c. distributing substations, their higher efficiency in operating, and cheaper plant for the consumer, as compared with the direct-current system, had for many years been apparent. In view of those facts many consumers were changed over, and the effect of that change, to many consumers, appeared to make confusion worse confounded. It was bad enough to have differences between one town and another, but differences now existed between street and street. The change was very expensive, but considerable cost might have been saved had the change just been from one system to the other; it was decided, however, to "go the whole hog" and raise the voltage. Manchester had not reached the electrical saturation point, and the demand was steadily increasing. There were 100 low-voltage feeders supplying direct current in the city per square mile, and in some parts the load density reached 35,000 kilowatts per sq. mile. It was apparent that the space underneath footpaths was limited, and sites for sub-stations were very few. To relieve the low-voltage mains new large-consumer buildings were connected directly to the high-voltage mains.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting on January 26th the subject of discussion was "High-voltage Distribution," with Mr. W. A. Ritchie in the chair. The discussion was opened by Mr. G. V. Twiss, who exhibited lantern slides to illustrate instances and examples, drawn mainly from distribution systems under his supervision in various parts of England and Wales. He remarked that as the result of the centralisation of generation, a complementary state of decentralisation was manifest in the greater use of electrical transmission. He preferred to describe as transmission lines those extra-high-voltage services whose function was to supply lower-voltage systems, and which were not tapped for supply at first hand. In the past lines of 3- and 6-kV were built as transmission lines, but when 11- and 20-kV lines came along the former tended to become distribution lines; similarly, when 33-kV transmission lines came along, all lower-voltage ones tended to become more of the nature of distribution lines. The transmission lines of 66 and 132 kV of to-day converted 33-kV lines mainly into distribution lines.

In rural-electrification schemes it was essential that capital expenditure should be reduced to the absolute minimum, and the advantages of overhead distribution were apparent, in that they reduced the cost of service and faults were easily located. The poles could also be used as lamp supports and so cheapen the cost of street-lighting schemes. In a small section described, 15 transformers had a total capacity of 1,300 kVA; their iron losses constituted a 24-hour load and necessitated the supply of about 60,000 kWh per annum. In assessing the copper losses of those transformers it should be noted that the load factor of the losses was smaller than the load factor of the system. Assuming a value of, say, 12 per cent. for the loss load factor, the copper losses would be about 20,000 kWh per annum. The total transformer losses therefore amounted to approximately 80,000 kWh per annum. In the electrification of rural and small urban areas the main requirement was economy consistent with reliability. Coincident with such economy of capital expenditure it was necessary that there should be a very high degree of efficiency in selling methods in order to secure the fullest use by the rural communities of the supply provided.

On the discussion being thrown open, Mr. Twiss kept a large meeting closely interested for long past the usual hour. The same type of transformer was used for indoor and outdoor services, and when asked what sort of demand was required to make a line practicable, replied that if the annual revenue of a service was about one-fifth or one-quarter of the capital outlay, the supply would be an economic possibility. The wiring contractor should be given every encouragement, as he could best bring in consumers and develop an area, but in new areas the contractor was not often available and was reluctant to come. It had been found that collaboration was the most successful method.

TEES-SIDE DANCE.—The Tees-side Sub-Centre of the Institution held its annual dance at Middlesbrough on January 31st, when there were over 150 guests. The Social Committee's arrangements were excellent in every respect. The Sub-Centre has now a membership of 112.

Faraday House Dance.

The Faraday House Old Students' Association and Rugby Club are to hold a supper-dance on February 26th at the Hotel Russell, London. The price of a double ticket, including supper, is 15s., and that of a single ticket 8s. 6d.; there will also be a buffet throughout the evening. Early application for tickets should be made to the F.H.O.S.A., Southampton Row, London, W.C.1.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. J. F. SARVENT, of the Hammersmith Electricity Department who has been appointed resident engineer at the Kirkstall power station, Leeds, was recently presented with a 400-day clock and a smoker's cabinet by the staff and members of the Electricity Department.

Mr. E. F. HOLLANDS, M.I.E.E., recently resigned from the position of general manager of the Timaru (N.Z.) Municipal Electricity Department, to take up the appointment of engineer and general manager to the Hutt Electric Power Board, Wellington. Before leaving Timaru Mr. Hollands was presented with a silver tea and coffee service by the South Canterbury Electric Power Users' Association and with a set of silver-mounted hairbrushes by the Timaru Rotary Club.

Mr. H. H. PERNICE of the Greenock Corporation Electricity Department, is sailing for Nigeria on February 12th to take up the post of electrical meter superintendent with the Nigerian Government.

Mr. R. W. STEEL, A.M.I.E.E., of the Stoke-on-Trent Electricity Department, has been appointed assistant mains engineer to the Newcastle and District Electric Lighting Co., Ltd.

Mr. A. H. Darker, A.M.I.Mech.E., A.M.I.E.E., consulting engineer of Messrs. J. Stone & Co., Ltd., is leaving England by the *Orontes* on February 15th for a world tour.

The Barking U.D.C. Electricity Committee recommends the appointment of Mr. W. G. Lamkin, Hastings, as installation superintendent.

The *Journal* of the British Chamber of Commerce, Shanghai, reports that Mr. N. G. Beale has been appointed general manager of the General Electric Co. of China, Ltd.; and that Mr. R. A. S. Waters, district manager in Manchuria for the China Electric Co., Ltd., has been appointed to control the latter company's offices in Peking, Tientsin, Mukden and Harbin.

Mr. K. Laing has been appointed manager of the Mansfield Tramways Co., in succession to Mr. R. F. Dixon. Mr. Laing has for the last six years been manager of the Lytham St. Anne's Corporation 'bus undertaking.

Mr. Thomas Medcalf, formerly secretary of the Swindon Corporation electricity undertaking and tramway manager, who was recently appointed transport manager, has tendered his resignation. He has been in the service of the Corporation for 25 years.

At the last meeting of the Lancaster Town Council, Mr. J. H. Bramley, formerly of Lincoln, was appointed chief assistant to the borough electrical engineer, on completion of two years' service, with salary according to scale.

It is announced that, owing to pressure of other business, Mr. H. M. Batty has resigned the secretaryship of Pye Radio, Ltd. He is succeeded by Mr. L. V. Slater.

Mr. R. M. Longman, M.I.E.E., is leaving the staff of the Yorkshire Electric Power Company, where for nearly nine years he has held the position of technical superintendent, to take up the appointment of chief assistant to Mr. S. E. Fedden, engineer of the Mid-East England area of the Central Electricity Board. At a complimentary dinner and dance given in his honour on January 27th, Mr. W. B. Woodhouse presented Mr. Longman, on behalf of the staff, with a stop watch and a large canteen of cutlery. Mr. Woodhouse was supported by Mr. J. J. H. Stansfield (secretary) and Mr. H. C. Fraser (superintendent of organisation). In addition to the dance, musical items were contributed by Messrs. Queen, Penman, Newton and Hughes, who are all members of the staff of the Yorkshire Electric Power Co.

Mr. C. F. Bolton, A.M.I.E.E., who has been connected with British Insulated Cables, Ltd., for the past 17 years, has been appointed by the Central Electricity Board as maintenance engineer in South-East England. During the last two years Mr. Bolton has been responsible for the construction of the first 132-kV primary transmission lines for the Board—those in the Central Scotland area. On January 25th, Mr. Bolton was entertained at dinner at White's Restaurant, Glasgow, and was presented with a canteen of cutlery and a silver cigarette box.

Elliott & Fry] [*London.*

Mr. C. F. Bolton, A.M.I.E.E.,

Who has been appointed maintenance engineer for South-East England.

We mentioned in our last issue that Mr. T. H. U. Aldridge, whose portrait appears herewith, was leaving Shanghai to take up a position in England with the American & Foreign Power Company. This is the company which purchased the Shanghai electricity undertaking from the Municipality last year for the sum of £10,000,000. Mr. Aldridge became chief of the Shanghai Electricity Department in 1901 and during his 28 years of service the capacity of the plant has risen from 550 kW to 161,000 kW, while an extension of 50,000 kW is under consideration. In the same period the output has increased ten-fold and was estimated at 537 million kWh last year. Mr. Aldridge was to sail for England, *via* New York, at an early date. He is succeeded by his deputy, Mr. C. S. Taylor, who has been with the undertaking since 1913 and has acted as deputy engineer-in-chief and manager for the past six or seven years.

Mr. T. H. U. Aldridge, M.I.E.E.,

Who has left Shanghai to join the American and Foreign Power Co. in London.

Mr. A. G. Collis, M.I.E.E., chief of the switchgear section of Crompton Parkinson, Ltd., has been elected to fill a casual vacancy on the Essex County Council for the Brentwood division. Mr. Collis is a member of the Brentwood Urban Council.

Mr. J. Foden, at present chief of the Contracts Department and formerly chief sales engineer and production manager with Messrs. Ferguson, Pailin, Ltd., is resigning his appointment as from March 22nd.

Mr. R. Appleyard was elected a member of the Royal Institution at a general meeting on February 3rd.

A number of leading members of the North-East Coast electrical and heavy industries entertained Mr. O. S. Nichols to dinner on the occasion of his leaving the position of Tees-side representative of the British Thomson-Houston Co., Ltd., to take up a similar post in Liverpool. Mr. P. Glover (Furness Shipbuilding Co., Ltd.), presided, and Mr. D. J. E. Richards (Synthetic Ammonia and Nitrates, Ltd.) proposed Mr. Nichols's health and wished him success. Afterwards, Mr. R. N. Crawford (British Insulated Cables, Ltd.) made a presentation of an engraved silver salver and a cigarette lighter to Mr. Nichols. The health of the latter's successor, Mr. A. D. Mackinnon, was proposed by Mr. H. Sanderson (Arthur Jones & Co.).

Mr. Murray Coombs, who has been in the Putney Hospital Nursing Home since January 8th, expects to return to his home in Brighton at the end of the week.

Captain L. J. Harris, O.B.E., A.M.I.E.E., is due in London on February 10th from Jerusalem where he is a member of the engineering firm of Harris & Bassan. He will be visiting the British Industries Fair, and he hopes to get in touch with English manufacturers there. His address whilst in London will be 12, Ladbrooke Terrace, W.11.

Obituary.—Mr. A. W. Woodyatt.—We regret to learn from the *South African Mining & Engineering Journal* of the death on December 31st of Mr. A. W. Woodyatt, managing director in South Africa of the English Electric Co., Ltd.

Mrs. W. N. Y. King.—We tender our sympathy to Mr. W. N. Y. King, A.C.G.I., A.M.I.E.E., on the death of his wife, which occurred on January 26th.

Mr. J. R. G. Groves.—The funeral took place at Barrow-in-Furness on January 31st of the late Mr. James Ritchie Gordon Groves, the former manager of the Barrow-in-Furness tramway undertaking, and was attended by the Mayor of Barrow,

members of the Corporation, the chief officials, representatives of the tramway undertaking, and others including Mr. H. Clayton, general manager of the tramways at Preston, who represented the Tramway Managers' Association. The deceased, who passed away on January 27th at the age of 64, began his career with the Edinburgh horse tramways in 1886, and was subsequently connected with the tramways at Cardiff, Yarmouth, Croydon, Peterborough, Worcester and Gravesend, and he was transferred to Barrow, as manager for the British Electric Traction Company, in October, 1918. When the Barrow Corporation purchased the undertaking in 1921, Mr. Groves was retained as manager, and he occupied the position until 12 months ago, when he resigned on account of failing health.

Will.—The late Mr. ARTHUR C. COCKBURN, F.C.S., M.I.E.E., consulting engineer, of Willesden Lane, N.W., left estate valued at £37,007 (net personalty £30,611).

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

International Telephone and Telegraph Laboratories, Inc.—Particulars of this company were filed on January 17th, pursuant to Section 344 of the Companies Act, 1929. The capital is $10,000,000 in $100 shares. The company was incorporated in Delaware, U.S.A., on November 16th, 1929, to carry on and promote investigation, research, experimentation and development in connection with transmission, with or without wires, of intelligence and information. The principle office is at 19-21, Dover Green, Dover Kent, Delaware. The British address is at Connaught House, 63, Aldwych, W.C.2, where G. H. Nash and R. A. Mack are authorised to accept service of process and notices on behalf of the company.

Goodalls (Merthyr Tydfil), Ltd.—Private company. Registered January 28th. Capital, £500 in £1 shares. Objects:—To carry on the business of buyers, sellers, letters on hire and manufacturers of and dealers in electrical and all other apparatus and things required for use in connection with the business of a wireless, television, home cinematograph apparatus, telephone, telegraph and heating supply company; manufacturers of and dealers in automobiles, &c. The directors are: W. Lewis, 19, Dane Street, Merthyr Tydfil. D. J. Powell, 9, Tydfil Terrace, Merthyr Tydfil (both permanent, subject to each holding 50 shares). Qualification: of directors, 50 shares. Solicitor: B. Hamilton, Merthyr Tydfil. Tydfil.

Dualite, Ltd.—Private company. Registered January 25th. Capital £21,000 in £1 shares. Objects: To acquire the goodwill and undertaking of Dualite, Ltd. (in voluntary liquidation), and to carry on the business of manufacturers, importers and exporters of and dealers in lighting and heating specialities and appliances used in connection with electric lighting, gas and oil; glass, glassware, electrical and wireless plant, &c. The directors are: R. W. Buckingham, Winsley's House, Colchester; W. H. Latchford, 15, The Grange, Wimbledon Common, S.W. (director of Du Bois Co., Ltd.); S. B. Bryant, 4, St. James's Place, S.W.1. Qualification: £50 shares. Registered office: 52 and 53, Fetter Lane, E.C.4.

Official Returns of Electrical Companies.

General Cable Manufacturing Co., Ltd.—Satisfaction to the extent of £1,600 on January 1st, 1930, of debentures authorised January 29th, and registered July 5th, 1928, securing £41,400.

Lancashire Electric Light & Power Co., Ltd.—Capital £3,171,415 in 571,415 6 per cent. cum. first preference, 1,000,000 7 per cent. cum. participating preference and 1,600,000 ordinary shares of £1 each. Return dated June 17th (filed October 30th), 1929. 511,440 first preference, 1,000,000 7 per cent. preference and 1,600,000 ordinary shares taken up. £3,109,040 paid. £2,400 considered as paid. Mortgages and charges, nil.

Octron, Ltd.—Capital £3,000 in 2,850 preference shares of £1 each and 3,000 ordinary shares of 1s. each. Return dated October 31st, 1929. All shares taken up. £3,000 paid. Mortgages and charges, £2,500.

Corwen Electric Light Co., Ltd.—Capital £2,000 in £1 shares. Return dated November 5th, 1929. 1,610 shares taken up. £1,610 paid. Mortgages and charges, nil.

Improved Wilson Microphone & Electrical Co., Ltd.—Particulars filed of £150 debentures authorised January 9th, 1930, charged on the company's undertaking and property, present and future including uncalled capital, the whole amount being now issued.

Electric Reduction, Ltd.—Capital £50,000 in £1 shares (16,200 preference and 33,800 ordinary). Return dated November 29th, 1929. 16,200 preference and 28,800 ordinary shares taken up. £18,000 paid on 13,000 preference and 5,000 ordinary shares. £27,000 considered as paid on 3,200 preference and 23,800 ordinary shares. Mortgages and charges: £25,000.

W. Mackie & Co., Ltd.—Capital £12,000 in £1 shares. Return dated October 3rd, 1929. 7,500 shares taken up. £3,155 paid. £4,345 considered as paid. Mortgages and charges, nil.

Hailwood & Ackroyd, Ltd.—Capital £25,000 in 3,200 preference and 1,800 deferred shares of £5 each. Return dated December 2nd, 1929. All shares taken up. £15,500 paid on 3,100 preference shares. £9,500 considered as paid on 100 preference and 1,800 deferred shares. Mortgages and charges, £50,000 sealed debentures.

E. A. Langrish & Co., Ltd.—Capital £15,000 in 7,500 preference and 7,500 ordinary shares of £1 each. Return dated October 10th, 1929. 5,965 preference and 5,800 ordinary shares taken up. £11,265 paid £500 calls unpaid. Mortgages and charges, nil.

Stuart Electrical Co., Ltd.—Capital £4,000 in £1 shares. Return dated July 2nd, 1929. 1,865 shares taken up. £502 paid. £1,363 considered as paid. Mortgages and charges, nil.

City of Oxford Motor Services, Ltd. (formerly City of Oxford Electric Tramways, Ltd.).—Satisfaction to the extent of £2,100 on December 31st, 1929, of trust deed dated February 20th, and registered February 25th, 1914, securing £46,000 debentures.

Cleartron Radio, Ltd. (Old Co.).—J. H. Stephens, 6, Clement's Lane, Lombard Street, E.C.2, ceased to act as receiver or manager on January 7th, 1930.

Gravesend & Northfleet Electric Tramways, Ltd.—Satisfaction to the extent of £265 on July 15th, and to the extent of £500 on October 21st, 1927, of debenture stock created by trust deed dated April 23rd, and registered April 25th, 1903.

United Electric Tramways Company of Caracas, Ltd.—Particulars filed of £75,000 debentures authorised December 19th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £55,000.

Bayliss, March & Newey, Ltd. (in voluntary liquidation).—Satisfaction (1) to the extent of £300 on September 30th, 1929, of debenture dated July 12th, and registered July 14th, 1927, and (2) to the extent of a like amount on October 4th, 1929, of debenture dated December 14th, and registered December 17th, 1928. (Notices filed January 25th, 1930).

W. F. Bridgwater, 3, Cherry Street, Birmingham, ceased to act as receiver and manager on January 21st, 1930.

R. Falshaw, Ltd.—Capital, £5,000 in £1 shares. Return dated December 25th, 1929. All shares taken up. £2 paid. £4,998 considered as paid. Mortgages and charges, nil.

Julius Sax & Co., Ltd.—Capital, £10,000 in 3,000 7½ per cent. preference of £1 each and 35,000 ordinary shares of 4s. each. Return dated December 10th, 1929. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares. £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges, nil.

Cutting Bros. & Co., Ltd.—Capital, £22,000 in 12,500 first cumulative preference, 7,500 second non-cumulative preference and 2,000 ordinary shares of £1 each. Return dated July 8th (filed December 2nd), 1929. 12,000 first preference, 4,550 second preference and 600 ordinary shares taken up. £10,000 paid. £7,150 considered as paid. Mortgages and charges: £10,000.

Simplex Conduits, Ltd.—Capital, £100,000 in 10,000 preference shares of £5 each and 50,000 ordinary shares of £1 each. Return dated October 31st, 1929. 10,000 preference and 40,000 ordinary shares taken up. £50,000 paid on the preference shares. £40,000 considered as paid on the ordinary shares. Mortgages and charges, nil.

Coniston & District Electric Supply Co., Ltd.—Capital, £3,500 in 2,500 6 per cent. preference and 1,000 ordinary shares of £1 each. Return dated October 12th, 1929. 2,253 preference and 500 ordinary shares taken up. £2,473 paid on 2,253 preference and 220 ordinary shares. £280 considered as paid on 280 ordinary shares. Mortgages and charges, nil.

J. G. White & Co., Ltd.—Capital, £350,000 in 360,000 ordinary shares of 4s. each and 278,000 ordinary shares of £1 each. Return dated July 4th, 1929. 360,000 4s. ordinary shares taken up. £66,000 paid. £6,000 considered as paid. Mortgages and charges, nil.

Turner, Atherton & Co., Ltd.—Capital, £140,116 in 62,861 preference and 77,255 ordinary shares of £1 each. Return dated August 16th, 1929. 49,172 preference and 51,597 ordinary shares taken up. £26,487 paid on 19,228 preference and 7,259 ordinary shares. £74,282 considered as paid on the remainder. Mortgages and charges, nil.

Bude Electric Supply Co., Ltd.—Capital, £15,000 in £1 shares. Return dated June 8th (filed November 1st), 1929. All shares taken up. £15,000 paid. Mortgages and charges: £2,500.

Horley & District Electricity Supply Co., Ltd.—Capital, £50,000 in £1 shares. Return dated October 29th, 1929. 20,640 shares taken up. £18,640 paid. £2,000 considered as paid. Mortgages and charges: £5,000.

Full Light Safety Lamps, Ltd. (formerly Full Light Anti-Dazzle Lamp (Parent), Ltd.).—Particulars filed of £3,000 debentures authorised January 14th, 1930, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

United Electric Tramways Co. of Caracas, Ltd.—Issue on January 21st, 1930, of £3,000 debentures, part of a series already registered.

Stevens & Cole, Ltd.—H. Rainsbury, 65-66, Basinghall Street, E.C.2, ceased to act as receiver on December 24th, 1929.

Excelsior Magneto and Ignition Co., Ltd.—C. R. W. Menzies, 2, Mount Street, Manchester, ceased to act as receiver on January 11th, 1930.

London & Provincial Radio Co., Ltd.—P. B. Settle, Market Street, Colne, ceased to act as receiver or manager on January 10th, 1930.

City Notes.

English Electric Co., Ltd.

Early this week particulars were published of a scheme for the reconstruction of the company's finances, involving the writing-down of the capital by about £1¾ millions and the raising of £750,000 of new money. It will be remembered that the company has not paid a preference dividend since 1926, while the last distribution on the ordinary shares was 5 per cent. in respect of 1924.

The term of the 5½ per cent. first mortgage debentures is to be extended by 20 years to 1960, the sinking fund instalments being correspondingly reduced. It is proposed to cancel the conversion rights of the 6 per cent. debenture stock. The holders will retain 35 per cent. of the stock, but surrender the balance for 6½ per cent. preference shares to the extent of 50 per cent. of their holdings and ordinary shares to the extent of 15 per cent. The issue of additional debenture stock is to be restricted according to the profits available, and will in no event exceed £750,000. The accrued preference dividend up to December 31st last is to be cancelled, and the £1 preference shares are to be written down to 12s. 6d., of which 10s. per share will be represented by preference shares and 2s. 6d. by ordinary shares. The £1 ordinary shares are to be reduced to 3s. 4d. and the preference and ordinary shares are to be consolidated into shares of £1 denomination. Thus, the holder of eight existing preference shares will receive four preference shares and one ordinary share. The preference dividend is to be raised from 6 to 6½ per cent.; it will be non-cumulative for four years and cumulative thereafter. After four years the preference shares will have voting rights if the dividend upon them is in arrear for not less than twelve months. The reduction in capital amounts to £1,755,528 (£368,838 preference and £1,386,690 ordinary). If the scheme is approved by the holders of the debentures and shares, Messrs. Lazard Bros. and Co., Ltd., have agreed to subscribe £750,000 for ordinary shares. This new capital will permit of the liquidation of bank overdrafts and provide a substantial sum for re-equipment.

Upon completion of the reconstruction, the company's loan and share capital will be as follows:—5½ per cent. first mortgage debentures, £656,200; 6 per cent. debenture stock, £450,863; 6½ per cent. preference shares, £1,135,874; ordinary shares, £1,343,511. The directors point out that the scheme will result in reducing the annual interest and sinking fund charges to £72,000. They state that unless the scheme is carried out they see little possibility of the business being continued in the present form, and liquidation is probable. In the event of a liquidation it is considered improbable that sufficient would be realised to meet obligations to the holders of the 6 per cent. convertible stock. The scheme is to be put forward at an extraordinary meeting on February 25th.

Perak River Hydro-Electric Power Co., Ltd.

In our issue of January 17th (p. 129) we outlined the scheme by which the company was to raise further capital. This matter was dealt with by Viscount Elibank (chairman) at the adjourned annual meeting on January 29th. He said that the directors regretted the causes which necessitated the placing of further loan money in front of the share capital, but it was important and helpful to the undertaking that the Federated Malay States Government had offered to lend them £850,000 at a low rate of interest. The board had throughout maintained the closest contact with the progress of the construction work. It had been impossible to estimate the probable ultimate cost of the civil engineering works until solid rock had been reached for the massive superstructure of the dam. Consequently the estimates for those works had been largely exceeded, but the excess expenditure on the electrical engineering side should not exceed 10 per cent. In order to ensure finality in the construction expenditure, the board had settled with the contractors a final, fixed sum for the completion of the Chenderoh dam, the power house buildings, &c. To finance the extension of the steam station it had been proposed to issue a further £250,000 of 7 per cent. participating debenture stock, but in view of the necessity of raising an additional £350,000 to complete the original scheme, this was deferred in favour of the scheme now before the meeting. The loan from the Government would rank as a charge immediately after the 5 per cent. debenture stock. The scheme would be of lasting benefit to the company. The construction scheme would have a potential annual output of about 160 million kWh, against the 100 million kWh for which it was originally designed. Already they were supplying 62 million kWh per annum and he claimed that the directors were justified in accelerating the construction of, and enlarging the steam station to meet the demand. The latest advices from Perak indicated that progress was being maintained and that trial runs would be started in April. In response to requests from the tin industry the company had drawn up an alternative tariff which should assist the industry without materially impairing the company's revenue. It was estimated that prospective business corresponding to 400 million kWh per annum was available. It might be expected that the tin industry would come into its own once more within a reasonable period and it would have at its disposal a supply of electricity which would compare favourably in price with any other form of power. The report was adopted and at subsequent extraordinary meetings the directors' proposals were approved.

Hall Telephone Accessories (1928), Ltd.

The net profit for the year ended December 31st last was £40,365, as against £30,094 in 1928, to which is added £4,631 brought forward, making £44,996. After providing for the interim dividend, setting aside for general and patent reserves and income tax reserve £22,200, and paying additional remuneration to the directors there remains £15,471. The directors recommend a final dividend of 6 per cent., together with a bonus of 2 per cent., both less tax, making 12 per cent. for the year, leaving £4,719 to be carried forward. Important orders for new types of automatic vending machinery have been obtained. The directors propose to increase the capital by the creation of a further 150,000 shares of 10s. each, bringing the total authorised capital to 500,000 shares of 10s. each. It is proposed to issue the 14,000 shares now remaining unissued out of the present capital and to issue a further 28,000 shares out of the new capital. If the increase of capital is approved, the shareholders will have the right to apply for the shares to be issued at the rate of one new share for every eight old shares at 11s. per share. The new shares will rank *pari passu* with the existing shares, and the 42,000 to be offered will rank for dividend as from January 1st, 1930. Meeting: February 10th.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Electric Fans, Ltd.
Hertz Radio Corporation, Ltd.
Local Electric Supplies Co., Ltd.
Metropolitan Electrical Contractors, Ltd.
Radiolicity, Ltd.
Westfield Wireless, Ltd.
Wireless Novelties, Ltd.

Traction and General Investment Trust, Ltd.

Presiding at the annual meeting on January 31st, Mr. H. A. Vernet (chairman) said that investments totalled £2,145,098, as compared with £2,116,530 in 1928. The percentage of appreciation was about five points lower than it was at the end of 1928, but this was inevitable in a year which saw the end of a great stock market speculation in the United States and Canada. The holding in public utilities had increased somewhat, and the investments in the United States showed a percentage increase. The report and accounts were adopted.

Stock Exchange Notices.

Dealings in the following have been allowed by the Stock Exchange Committee under Rule 159 :—

Central Electricity Board.—£7,000,000 five per cent. stock 1950-70, issued at £97½ per cent., partly paid and fully paid.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—150,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 2,150,001 to 2,300,000.

The undermentioned have been ordered to be officially quoted :—

Crompton Parkinson.—600,000 ordinary shares of 5s. each, fully paid, Nos. 50,001 to 650,000.

International Telephone and Telegraph Corporation.

A banking syndicate headed by Messrs. Morgan announced last week that it was offering $50,000,000 of International Telephone and Telegraph Corporation 25-year 5 per cent. debenture bonds at a price of 96½. The proceeds are to be used to liquidate indebtedness contracted by the company in financing improvements made during 1929 and also to provide capital for further improvements in the properties owned, principally those in America, Germany, Spain, Argentina, and Chile.—*Reuter* (New York).

A later message stated that the issue had been considerably over-subscribed.

The Central Electricity Board Issue.

The response to the Central Electricity Board's invitation to the public to subscribe to an issue of £7,000,000 of 5 per cent. stock, at £97½ per cent., was very poor, the underwriters being left with about 92 per cent. of the stock. The Board's first issue met with a similar reception. This was £3,000,000 of 4 per cent. stock at £83 per cent. and only 22 per cent. was applied for.

Andhra Valley Power Supply Co.

The net profit for the year ended June 30th last amounted to Rs.7,36,183, as compared with Rs.6,56,286 for 1927-28. After deducting sums as provision for depreciation on investments and for the preference dividend, and a sum written off against loss on investments sold, the directors proposed the payment of a dividend of 2 per cent., free of tax, on the ordinary shares, leaving Rs.29,189 to be carried forward.

Tata Power Co.

The net profit for the year ended June 30th last was Rs.2,71,521, against Rs.80,147 for 1927-28. The directors recommended the payment of a dividend at 7½ per cent. per annum on the preference shares for the three months ended June 30th, 1927, the carry-forward being increased from Rs.5,078 to Rs.1,19,024.

London Power Co., Ltd.

The net revenue for 1929 was £866,373, as compared with £683,490 in 1928, while interest yielded £53,528, as against £4,896. The directors recommend a dividend of 6 per cent. on the share capital of £50,000. The output of electrical energy during the year increased from 593,915,537 to 733,238,288 kWh, and the kW demand from 242,700 to 270,500. The effective plant capacity totalled 355,000 kW.

Metropolitan Railway Co.

A final dividend of 2¾ per cent. is recommended on the ordinary stock for the year 1929, making 4 per cent. for the year, as against 3½ per cnt. in 1928. The dividend on the surplus lands stock is 2¾ per cent., making 3¾ per cent., as against 3¾ per cent. in the previous year. £10,000 is again allocated to reserve and £32,016 carried forward.

Western Union Telegraph Co.

The earnings for the past year, with the December figures estimated, shows a gross revenue of $148,387,403, against $139,387,320 in 1928. The total expenses were $129,286,765, as against $120,310,256, and after deducting interest on bonded debt, there is a net income of $15,490,573, as compared with $15,467,659.

Westminster Electric Supply Corporation, Ltd.

A final dividend of 13.12d. per share has been declared on the ordinary shares, making up the "standard" dividend of 1s. 9.12d. for the year ended December 31st last.

City of Buenos Ayres Tramways (1904), Ltd.

After transferring £10,000 to amortisation and general fund a final dividend of 1s. 3d. is proposed, making 5 per cent., less tax (as for 1928), and £501 is carried forward.

Dublin United Tramways Co.

No ordinary dividend is being paid for the year 1929, against 4 per cent. in 1928. The directors are setting aside £20,000 for renewal of track and carrying forward £12,037.

St. James' & Pall Mall Electric Light Co., Ltd.

A dividend of 9.949d. per share has been declared on the ordinary shares making, with the interim dividend already paid, the standard dividend for the year.

Swiss Company.

The *Company for Electrical and Industrial Undertakings in the Orient*, Zurich, reports net profits of 1,034,000 fr. for 1929, as compared with 921,000 fr. in the previous year. The dividend is maintained at 10 per cent. on capital of 6,000,000 fr., as against 5,000,000 fr. in 1928.

Stocks and Shares.

TUESDAY EVENING.

BUSINESS conditions in the Stock Exchange are far from brisk. A variety of conflicting cross-currents make it difficult for either investment or speculation to see its way, as the Stock Exchange term goes. Opinions in regard to the prospects for money differ on the point as to whether the Bank Rate is likely to come down or not within the early future; yet, on the other hand, new issues continue to make their appearance at prices which seem relatively high if the Bank Rate is not to be reduced fairly soon. The lifting of the clouds which have overhung the Stock Exchange through the Hatry collapse should be duly consummated next week. This will roll away one of the principal causes of uncertainty that has hampered business since last September. Ahead, however, there lie the unknown factors that are contained in the first Budget of the present Government. Advance hints are in circulation as to the likelihood of taxation being increased because of the disappointing revenue results. All things considered, the Stock Exchange markets show a good deal of resistance to elements that threaten their peace, and, taking our own price lists as an example, it may be said that quotations are standing up very well to the conditions that make for caution, if not hesitation, on the part of the investor.

New Issues.

Mention has been made of the high prices at which the new stock is being offered, and the Central Electricity Board issue of £7,000,000 in 5 per cent. stock, 1950-1970, which came out at 97½, turned out to be a fiasco so far as public subscription was concerned. The lists were kept open for the full advertised time, but, in spite of this, the public took no more than 9 per cent. of the total issue, and over £6,000,000 stock was left in the hands of the underwriters. It was therefore natural that the price should open at a discount. After it had sagged to the neighbourhood of 2½ discount, a rally took the stock to 1 discount. The North-West Midlands Joint Electricity Authority 5 per cent. stock, 1950-1970, came out, it may be recalled, at a point higher than that of the Central Electricity Board, and here the discount stands at 2 with plenty of stock available for those who care to take it. It is said that several other substantial new issues are on the point of making their appearance.

An interesting and novel loan is that which has been negotiated between Siemens & Halske—the German firm— and an American finance house. The loan is to run for a thousand years, the lenders have the right to vary the terms at the end of three-quarters of a century. The American portion will be for $14,000,000 in participating debentures at 233 per cent., with a guaranteed 6 per cent., and participation regulated by the dividend paid on the ordinary shares. The General Electric Company of New York is said to be taking a considerable amount of the debentures.

Home Railway Stocks.

The Metropolitan Railway has duly declared the 4 per cent. dividend for 1929 to which anticipation had looked for some time past. As already mentioned here, this was the conservative estimate, some of the more sanguine prophets going for as much as 4½ per cent. for the year. The actual result is regarded as being distinctly satisfactory, but the natural effect it had upon the prices was to bring in a few profit-takers, and the price fell 1 to 64. Districts are a little better at 74½. Underground Electric Railways stock and shares have not moved. Central London assented ordinary is a point higher. The dividends from the Underground group, including the London General Omnibus Company, are due for declaration on Thursday in next week, February 13th. A good deal of interest attaches to the dividend that will be declared on Underground Electric ordinary shares, estimates having ranged between 6 per cent. on the one hand, and 8 per cent. on the other. Possibly the actual result will maintain the 7 per cent. paid for the previous twelve months, and, if this is repeated, the yield on the shares at the present price will be a little over 5 per cent. on the money. The London & North-Eastern has officially announced its consideration of the construction of a tube for the conveyance of suburban traffic between Liverpool Street and Ilford. The company is in communication with a well-known firm of engineers, with a view to preparation of plans and estimates. The company has had a preliminary talk with Mr. J. H. Thomas in connection with the scheme, the carrying-out of which will involve, of course, substantial expenditure, and will give a large amount of work over a lengthy period.

Several London tramway issues are slightly better, a mild demand continuing for London & Suburban Traction preference. Vague hopes are hinted as to the possibility of the heavy arrears of dividend on these shares, being dealt with at some early date.

Cables and Wireless Slump.

No little indignation has been aroused by the publication of a statement, that the Post Office, instead of collaborating with Cables and Wireless in foreign telephony business, has been working in conjunction with interests associated with the American Telephone & Telegraph Company. The effect was to bring about a slump in the prices of Cables & Wireless "A"

and "B" ordinary stocks, the former having shed no less than 10 points, and the latter losing 6. The preference is 2½ down, at 96. Actually, the amount of business that may have been lost to Cables & Wireless through the Post Office dealing with the American Telephone & Telegraph Company is nothing very much when considered in relation to the 30 millions capital of the combine, but the moral effect is damaging to the latter, and dividend fears are again rife, with the result that prices collapsed, as just stated. It is now asked whether the Cables & Wireless ordinary stock is likely to receive more than 3 per cent. for the first year's working, which finished with the end of December last, though the answer to the surmise must rest upon a number of considerations at present unknown to the public: one being, for example, whether the whole of the preliminary expenses will be written off during the past year's working, or whether it will be spread over a period of years. The only answer made by the Post Office came from the Prime Minister in the House of Commons, when he said that the Postmaster-General had not refused to employ Beam wireless for overseas telephony. On the contrary, he added, the matter was under consideration, and a Cabinet Commitee has been appointed to report upon it. Marconi Marine shares are weaker at 2¼. A good deal of business is taking place in Radio Corporation shares, the price of which, after being better, eased off to 38¼.

Home Electricity Supply.

Metropolitan Electric ordinary shares are something of a feature of strength in the lighting list, the price hardening to 38s. 3d. on what is thought to be a recurrence of American demand. County of London ordinary eased off to 45s. 9d., and the new shares to 6s. 9d. premium. Urban ordinary are 1s. 3d. better at 33s. 8d. Egham and Staines have fallen 2s. to 31s. Richmond (Surrey) Electric ordinary at 42s. are a shilling lower. North Metropolitans are a better market at 45s. 9d. Isle of Thanet ordinary keep at about 31s., the preference being 23s. 6d. Newcastle and District are steady at 27s., and Northamptons at 44s. 6d., neither showing any change on the week. British Light & Power shares at 12s. 6d. are very quiescent. The Shropshire, Worcestershire and Staffordshire Electric Power Company recently placed a line of its 6 per cent. preference shares, which are now being offered at 22s. free of stamp and fee. There is a full six months' dividend payable next month. The price asked for the shares looks high, but the security is certainly ample.

English Electric Reorganisation.

The English Electric Company publishes a scheme of reorganisation of capital, which, if carried through, will have the effect of supplying the company with fresh funds, and placing its finances upon a healthy basis. The scheme is drastic in the writing down which it suggests. For some time past, however, it has become increasingly apparent that proposals of this sort would be necessary if the company were to maintain its position in the important industry with which it is connected. Complete details of the plan are printed in another column. The market for shares in cable and electric manufacturing companies shows a disposition to droop. Enfield Cables have fallen ½ to 4⅛, British Insulated remain dull at 3¼. The bright exception to dulness is provided by Telegraph Constructions, the price of which has risen another £1 to 27, having come up recently from 24½. British Aluminium are easier at 44s. 6d. Associated Electrical Industries have shed a shilling. The same dullish tendency is noticeable in iron and steel and allied shares. Babcock & Wilcox have shed a few pence to 59s. 6d. Vickers remain at 8s. 7½d. There is nothing doing in the rubber market.

A Flourishing Business.

Hall Telephone Accessories propose to create a further 150,000 shares of 10s. each, making the authorised capital £250,000. It is intended to offer 42,000 new shares for subscription to shareholders at 11s. each, one new share being allotted in respect of every eight old shares held. The price of the latter is 14s., and, as the company is doing extremely well, proprietors should have no hesitation in subscribing for their rights. The company has announced a dividend making 12 per cent. for 1929, the report breathing a spirit of cheerfulness that makes a refreshing contrast to the tone of so many other industrial companies at the present time.

The Perak River Hydro-Electric Power Company shareholders have agreed to the raising of the capital to which reference was made here last month. The price of the shares is 11s. 6d. The 7 per cent. participating debenture stands at 104 ex dividend, and the company's 5 per cent. guaranteed debenture stock, which is covered by the T.F.A. guarantee, is quoted at 98.

Dollar Stocks.

The Montreal Light, Heat & Power Company, in its report for 1929, shows earnings on the common stock equal to $4.28, as against $3.85 in the previous year. The price of the shares is unchanged at 138½. Pennsylvania Water shares at 77½ are also without alteration. Power Corporation of Canada rose a dollar to 78½. Canadian General Electric at 265 are 10 lower. Hydro-Electrics are steady at 43¾. Brazilian Tractions at 40 are a point down, and the preferred still stand at 135. Shawinigan Water shares remain at 81.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1927.	1928.	Price Feb. 4 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	8⅞	—	4 18 0
Brompton Ordinary	1	8½	8½	25/6	—	5 9 10
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	22/-	—	4 7 8
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	36/8	—	4 8 9
County of London	1	7	10	45/9	—¢d.	4 7 4
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	47/-	—	4 13 7
Kensington Ordinary	1	6	6	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/6	—	5 9 1
London Electric	1	8½	9	35/6	—	5 5 8
Metropolitan	1	9	9	38/3	+9d.	4 14 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6¾	6¾	28/-	—	4 12 10
Mid. Elec. Power	1	15	8	33/9	—	4 14 10
Newcastle-on-Tyne Ordinary ...	1	6	6	23/9	—	5 1 1
do. 7% Pref.	1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 4
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	1	8	8	35/6	—	5 9 10
Scottish Power	1	8	8	30/-	—	5 6 8
South London	1	8½	8½	26/-	—	5 7 8
Urban Ordinary	1	7	7	33/9	+1/3	4 5 2
Westminster Ordinary	1	8½	8½	35/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	32/6	—	4 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	71	+1	5 11 1
Metropolitan	"	3	3½	64	—1	6 5 0
do. District	"	4	5	74½	+½	6 16 2
Underground Electric	£1	5	7	23/-	—	6 1 9
do. do. Income ...	Bonds	6	6	108	—	5 11 1

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	102½xd	—	5 17 1
do. Def.	"	1½	1½	24	—	6 5 0
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	96	—2½	5 14 8
do. A 7½ Ord.	"	—	—	69½	—10	... ...
do. B Ord.	"	—	—	30½	—6	... ...
Globe Tel. and T. Ord.	10	10	10	33½	—½	*4 5 1
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	20	20	31	—	6 9 0
Marconi-Marine	1	12½	15	45/-	—1/3	... ...
Oriental Telephone Ord	1	12	12	21⅛	—	*4 5 5

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅛	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	3⅛	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 7 3
British Electric Traction Def. Ord,	"	5	5	157/6	—	... ...
do. do. Pref. Ord.	"	8	8	134½	—	6 8 6
Brazil Traction	100	7	8	40	—1	5 0 0
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	89½	—	5 11 9
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	50½	—	7 18 0
Mexico Trams, 6% Bonds	—	5	5	69⅛	—	8 0 0
Mexican Light Common	100	Nil	Nil	81	+11	... ...
do. 7% Pref.	100	7	7	72½	—	9 18 2
do. 1st Bonds	—	5	5	72½	—2	6 18 0
Victoria Falls Ord.	1	15	15	9	—	5 0 0
Yorkshire (West Riding)		Nil	Nil	8/-	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	—	26/6	—1/-	4 10 3
Babcock & Wilcox	1	10	15	59/6	—6d.	*5 1 8
British Aluminium Ord.	1	10	10	44/6	—⅛	*4 7 4
British Elec. Transformer Pref. ...	1	7	7	10/-	—	... ...
British Insulated Ord.	1	15	15	3¼	—⅛	8 17 4
Brush Ord.	Stock	10	10	136½	—	7 18 1
Callenders	1	15	15	3½	—	4 1 1
do. 6½% Pref.	1	6½	6½	1⅝	—	5 4 0
Crompton Parkinson Ord.	£/-	—	80	20/9	—	7 4 3
do. 5% Pref.	1	5	5	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 9
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	6½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4⅜	—⅛	4 6 5
English Electric	1	Nil	Nil	5/-	—	... ...
do. do. Pref.	1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	1	6¾	6¾	24/-	—	5 8 4
do. Ord.	1	10	10	2⅛	—	4 6 7
Henley	1	25	30	6⅛	—	4 18 8
do. 4½% Pref.	6	4½	4½	4⅛	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	36/3	—	5 10 3
Siemens Ord.	1	7½	7½	25/-	—	6 0 0
Telegraph Construction	12	10	10	27	+1	*4 9 0

*Dividends paid free of Income Tax.

The Physical Society's Exhibition—IV.*

Annual Display of Electrical Instruments and Scientific Apparatus.

Cambridge Instrument Co., Ltd.

When the ordinary type of sensitive moving-coil galvanometer, the coil of which is pivoted between two jewels, is subjected to shocks or vibration there is a danger of the pivots becoming deformed, resulting in an increase of friction and consequent inaccuracy in performance. This defect may be mitigated by mounting the jewels in which the pivots are supported on springs, but there is little space available for

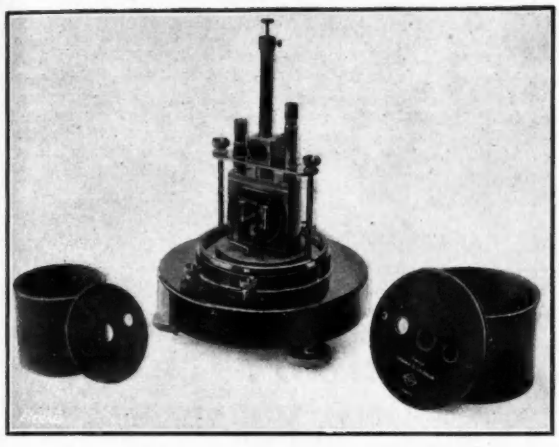


Fig. 1.—Moving-magnet Shielded Galvanometer.

accommodating springs of adequate resilience. In the new form of magnetic suspension the bearings of the moving system, with their supports, are attached to a member which is magnetically supported by, and floats in, the field of the galvanometer magnet. The device is most effective when the axis of the coil of the galvanometer is vertical, but it will function reasonably well when the galvanometer is tilted through considerable angles. The moving coil of the galvanometer is pivoted upon two jewels mounted on the ends of a light vertical rod passing through, and free to move vertically in, the centre of the iron core which is, as usual, rigidly attached to the fixed part of the instrument and located at the centre of the gap between the pole pieces of the galvanometer magnet. A horizontal soft-iron disk is fixed to the vertical rod, immediately above the iron core. The magnet induces magnetism both in the core and in the soft-iron disk, which thus become, in effect, magnets with like poles opposite each other, so that they tend to repel one another; the repulsion is amply sufficient to support the disk in stable equilibrium at a certain distance above the core. The disk cannot rise indefinitely, as it is magnetically held down in the field of the magnet, and the repulsion of the core decreases as the distance increases. The soft-iron disk and the vertical rod carrying the jewels do not rotate, but the moving coil which carries the gavanometer pointer rotates freely on the jewel pivots when the current in the coil varies. The movements of the coils are controlled in the usual way by means of hair springs, which also serve for leading the current in and out of the coils; owing to their shape and size the hair springs have practically no effect in supporting the weight of the coil, but that weight, together with those of the vertical rod and the soft-iron disk, is entirely floated by the magnetic repulsion between the core and the disk. Alternatively the iron core may be divided into an upper and a lower portion, and the soft-iron disk mounted near the middle of the vertical rod, practically midway in the gap betwen the two portions of the core. The disk is thus repelled from both parts of the core, and will occupy a position approximately in the middle of the gap. The device can be applied to galvanometers using permanent magnets or electromagnets, and to other forms of electrical measuring instruments.

The simple moving-magnet galvanometer shown in fig. 1 possesses the general characteristics of the Broc galvanometer, but the moving system is shielded from ordinary magnetic disturbances, a modification that considerably increases the usefulness of the instrument, which will be found suitable for many applications hitherto only covered by the more expensive Paschen galvanometer. The magnetic shielding is effected by close-fitting shields of iron and "Mumetal," which enclose a single pair of coils. The latter normally have a resistance of 10 ohms, but coils having resistances of 100 or 1,000 ohms may be supplied; they may be connected either in series or in parallel. The moving system is suspended by a quartz fibre (3 to 5 μ in diameter) and consists of four cobalt-steel magnets mounted on a light rod which also carries a mirror and clamping disk. The provision of two small control magnets, which are supported inside the shields on axes parallel to the suspension, enables the period of the instrument to be readily adjusted.

A string galvanometer similar in principle to the instrument developed by the late Prof. Wertheim Salomonson, but with the electromagnet replaced by a permanent magnet (fig. 2) enables more constant sensitivity to be obtained, and the vibrator has been somewhat simplified in design to facilitate interchangeability. The deflections of the fibre may be conveniently observed by means of a microscope, which may be mounted with the galvanometer on a stand, forming a compact and convenient outfit. When fitted with a copper fibre, 11 μ in diameter, and having an approximate resistance of 11 ohms, there is a deflection of 0.001 mm. per microampere. The period is about 0.0012 second and the approximate factor of merit is 27,000.

The construction of a.c microammeters incorporating Westinghouse metal rectifiers has enabled the sensitive moving-coil galvanometer to be adapted for the measurement of alternating currents down to a few microamperes. At the same time, the advantages of robustness and uniformity of scale associated with the moving-coil instrument are obtained; another advantage is that the torque/weight ratio is smaller than that of a moving-iron instrument, with the result that the deflecting forces need only be small and hence the power consumption is reduced to the minimum. Two types were shown: the lower range one is self-contained and made in two ranges only, from 0 to 100 and from 0 to 200 microamperes, respectively, and cannot be used with range multipliers; the higher range pattern has a separate rectifier, enabling the galvanometer to be calibrated for ranges to 500, 1,000, or 2,000 microamperes. The rectifiers are fitted with tangs for attachment to the thermal terminals of a 4-terminal galvanometer, which may be used for a.c. or d.c. measurements, since for the higher ranges the scale follows a

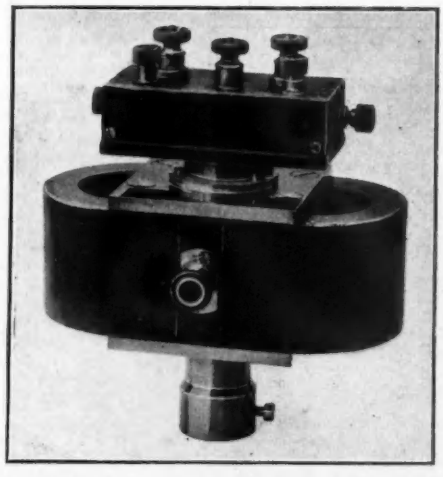


Fig. 2.—Galvanometer Permanent Magnet.

perfect linear law, which is applicable equally to a normal direct current or to a rectified alternating current.

G. Cussons, Ltd.

Amongst other exhibits the company demonstrated new power-factor vector apparatus that is intended primarily to assist the teacher of alternating-current theory and to help the non-mathematical student to comprehend what is often an obscure series of phenomena. It is not a questionable sort of analogy, nor does it teach the student anything which he may need to unlearn or modify later. Although intended originally to illustrate power-factor, it demonstrates practically anything involving the product of sinusoidal quantities of equal frequency convincingly, and the apparatus may be

* Parts I, II, and III of this series were published in our January 17th, 24th, and 31st issues.

used to illustrate phase relations existing in experimental work in the laboratory as well as in the lecture room. Sinusoidal curves of voltage and current are drawn in black and red on transparent celluloid sheets and the resultant power curve is somewhat similarly depicted; self-contained mechanism of kinematic design operates the various curves, and the energy delivered to the system is represented by a blue area; that withdrawn is shown by a yellow area; the magnitude of the areas is automatically altered in accordance with the change of phase. The apparatus may be of service to the power engineer who desires some means of illustrating to his consumers some of the technical terms employed, the economical effects of low power-factor, and of the justice of power-factor penalties, &c.

Electroflo Meters Co., Ltd.

Equipment for the automatic control of a large capacity electric furnace comprised a pyrometer in which contacts associated with the temperature-indicating movement are operated by auxiliary energy to regulate, through the agency of a contactor switch, the current supplied to the furnace. A device contained inside a small casing mounted on the front of the panel automatically disconnects the furnace from the heating supply in the event of the thermo-couple burning out or becoming disconnected. Red and green lights indicate whether the temperature being controlled is higher or lower than is desired, and a time switch may be set to operate at pre-determined times. The temperature-indicating movement is a double-pivoted moving-coil galvanometer of very light weight, and its great sensitivity enables a high circuit resistance to be employed. According to the position of the pointer of the galvanometer relative to an adjustable index, the furnace is connected with or disconnected from the heating supply, the pointer acting merely as a trigger, releasing a comparatively large amount of energy (provided by a small electric motor) when necessary, to operate the contacts determining the position of the contactor switch, which controls the supply of current to the furnace. A very similar arrangement may be used in conjunction with motor-operated fuel and air valves and dampers, &c.

A motor-driven CO_2 recorder and transmitter shown utilises a gear pump driven by a fractional horse-power motor to draw into the instrument the gas to be analysed. Means are provided to reduce the gas to atmospheric temperature and pressure; a measured volume passes through a solution which absorbs any CO_2 present. The remaining gas collects under an oil sealed bell, causing it to rise to a height inversely proportional to the proportion of CO_2 in the sample of gas analysed. The recording pen positions itself according to the height to which the bell rises, and is held in this position by a brake while the gas discharges from the bell and a new sample is taken. The record made by the instrument is a continuous line on the chart. The mechanism by which the reading is transmitted to distant instruments is simple and ingenious: when the bell is in the measuring position a push rod operated by the driving motor releases a tappet arm, which is slightly biased, and which falls until its motion is arrested by a tappet carried by the bell, when it is clamped in this position. The spindle carrying the tappet arm has bearings in a floating lever, and also carries a wheel which has two pins projecting from one of its faces. When the tappet arm is clamped the floating lever is depressed by the push rod and the pins carried by the wheel engage with, and position, a cross-piece secured to the spindle of a rheostat connected in series with the distant instruments, which are voltage controlled and give readings corresponding to those of the transmitting instrument.

The Thirsk Totalisator.

Some technical particulars of the new standard electrically-operated machine of the Racecourse Betting Control Board.

THE Racecourse Betting Control Board's new standard electric totalisator, a working installation of which has been installed at the Thirsk racecourse, was demonstrated to a gathering of Press representatives on January 28th. It has been supplied to the order of the Board by the British Thomson-Houston Co., Ltd., and utilises Strowger automatic telephone exchange equipment as made by the Automatic Telephone Manufacturing Co., Ltd., which holds world patents for its design and use. The equipment is mobile, its component parts being assembled into compact self-contained units, convenient for transportation from course to course as may be required. The totalisator demonstrated is designed for six horses only, and includes the following main items: ticket-issuing machines; collecting switches; adding machines; indicators; and a central control board.

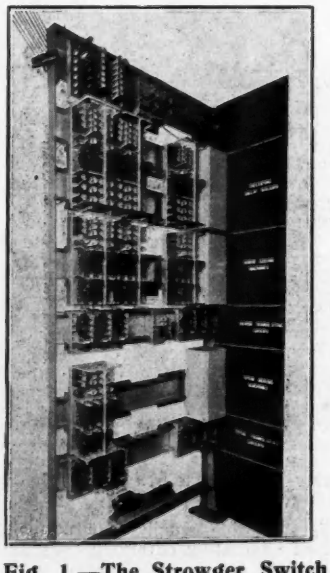
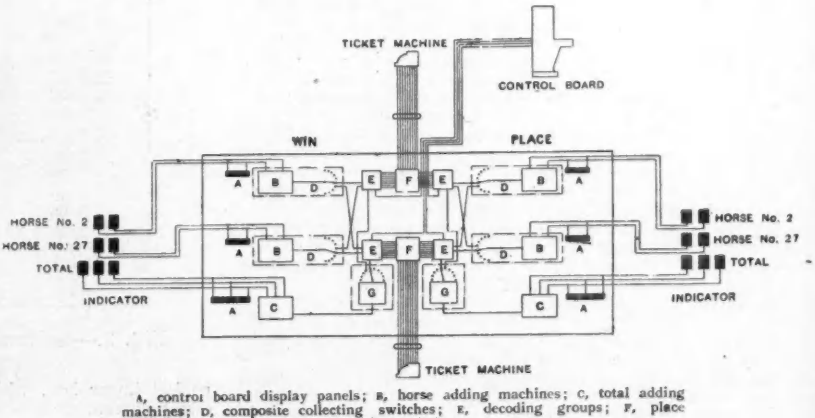


Fig. 1.—The Strowger Switch and Relay Groups.

It is capable of extension to fit the working requirements of any racecourse, large or small. The "heart" of the "tote" is contained within a very small compass, but at the same time it is capable of handling efficiently and expeditiously any required turnover from £1,000 to £100,000 or more.

The machine can remain in operation until the actual start of the race; all the money deposited in the last few minutes is collected by the machine, and not lost, as may sometimes be the case with the slower hand-worked machines, which have to be closed down an appreciable time before the "off," in order to have the dividends ready as soon as possible after the horses have been weighed in. Immediately the "off" has been signalled, the mechanism is locked, thus making it impossible for a ticket to be issued after the race has started.



A, control board display panels; B, horse adding machines; C, total adding machines; D, composite collecting switches; E, decoding groups; F, place change-over groups; G, total collecting switches.

Fig. 2.—General Arrangement of Totalisator Circuits.

Depression of the various keys in response to the requests of backers closes electrical contacts and sets up series of impulses which actuate the Strowger mechanism. Only ten wires, apart from battery leads, are required between an 80-horse ticket-issuing machine and the Strowger switch and relay groups of the main equipment; this is claimed to represent a marked economy in cabling between the machines and the central equipment, as well as reducing the possibility of breakdown due to cable faults.

Any number of ticket-issuing machines can be accommodated, and there are different machines for the five denominations or values of individual stakes, *viz.*, 2s. (the unit), 10s., £1, £10 and £100.

From the ticket-issuing machines the circuits (ten wires per machine) pass to the main equipment, which comprises the following Strowger switch and relay groups: the "place" change-over relay group, consisting of a number of relays, the function of which is to discriminate between "win"

Fig. 3.—Front of Demonstration Indicator.

and "place" bets before these reach their respective adding machines for registration; and the decoding relay group, which receives the signals over the ten wires from the ticket-issuing machine, transforms them into their corresponding betting equivalents, and, if all is in order, passes them on for registration by the adding machines. The latter group responds to operation of the horse number and "win" or "place" keys on the ticket-issuing machine, making the corresponding selection. On depression of the stake key the group releases the bet for registration on the adding machines.

Interposed between the decoding relay group and each adding machine are the collecting switches. These comprise Strowger heavy-duty rotary line switches, and their function is successively to collect the bet signals from the various ticket-issuing machines. Whilst betting is in progress these switches are in continuous rotation at a speed of about 50 r.p.m., the brushes traversing 2,400 contacts per minute. This high speed provides an ample margin for coping with the busiest pre-race period, when hundreds of ticket-issuing machines may be in use simultaneously.

Strowger heavy-duty rotary line switches in association with relays comprise the adding machines, of which there is one for each horse "win" and each horse "place," together with two total adding machines, "win" and "place," respectively. The adding machines are interchangeable, and their name implies their function, *viz.*, that of aggregating the bets received from the collecting switches and transmitting the resultant totals to the indicator for visual display. The maximum capacity of each adding machine is 2,400 bets per minute, of each denomination, or a total of 12,000 bets per minute. In the unlikely event of this capacity being exceeded, the machine automatically controls ticket issuing, which is held up until the adding machine has overtaken its arrears and is again in a condition to register bets.

The whole of the Strowger switch and relay groups are mounted on single-sided racks, at a convenient central point, as shown in fig. 1. The individual groups are all arranged to "jack-in" on horizontal pressed-steel shelves of channel section, the arrangement being such that any group can be immediately detached or replaced without disturbing the permanent wiring or interfering with the general progress of betting. This method of mounting and wiring Strowger equipment coincides with that recently developed for the British Post Office by the Automatic Telephone Manufacturing Company, Ltd.

Each group has an individual dust-proof metal cover, whilst slip-on covers also protect the wiring, tags, &c. The flexibility assured by the universal "jack-in" principle is another important advantage, and in the case of the R.B.C.B. standard totalisator, enables all equipment to be removed and stored, except when required for a race meeting, leaving only the racks and permanent wiring *in situ*. The "jack-in" principle applies similarly to the ticket-issuing machines, as well as to the component sections of the indicator about to be described. The indicator of the totalisator is on the lamp-monogram principle, each unit or numeral comprising a bank of 24 "Mazda" lamps, the lighting of selected groups of which form luminous figures in accordance with the signals transmitted by the adding machines.

The front of the demonstration indicator at Thirsk, illustrating the effect when totals are displayed, is shown in fig. 3. It will be seen that there are six banks of lamps or monograms in line with the number of each horse, and seven for the respective totals, "win" and "place." Every lamp is light-insulated from its neighbour, housed in a blackened background and surmounted by a blackened grille, the result of this arrangement being that the illuminated figures are clearly visible in direct sunlight from a distance of over 150 yards to the public on the course, and from any angle up to 30 deg. Associated with each figure is the mechanism for controlling the grouping of the lamps for lighting in accordance with the received signals, both the mechanism group and the bank of lamps being on the "jack-in" principle and interchangeable. Individual monograms and their associated control units can be removed during the progress of betting without affecting the totals, which will indicate correctly and in accordance with the amended figures immediately the indicator units are replaced in circuit. If necessary the indicator can be arranged to display simultaneously on both sides, and any number of subsidiary indicators can be worked in parallel with the main indicator, without additional equipment or regard to their location.

The central control board, fig. 4, is the key to the entire totalisator installation, and enables the fullest possible control over the betting, including all ticket-issuing machines and the horses running in each race, to be exercised by one individual, if necessary. It is equipped with a number of keys, and corresponding signal lamps, one key representing each horse and each total adding machine, "win" and "place," respectively. Betting is started by manipulation of the corresponding keys at the control board. Thus, if both "win" and "place" betting are permitted, the total "win" and total "place" keys are operated, followed by the various horse "win" and "place" keys representing the actual runners. If there is no "place" betting these keys are left normal, and it is impossible for the ticket-issuing machines to accept "place" bets.

Restoration of the horse and total keys to normal immediately stops all betting, inasmuch as the issue of tickets is controlled from the adding machines, and a horse adding machine cannot continue in service unless the corresponding total adding machine is also working. The signal lamp associated with each key glows as long as the key is in the operating position, and enables the controller to see at a glance what portion of the equipment is working and registering bets. Furthermore, a miniature replica of the main indicator, seen to the right of the control board, reproduces the horse and total figures simultaneously with their display on the main indicator, thereby keeping the controller informed of the state of the betting at any moment. By means of a master key the end of the betting period, which coincides with the start of the race, may be controlled by the starter or other official from the starting post, remote from the control board. Manipulation of this key stops the issue of tickets at all machines on the course, and simultaneously the signal lamps at the control board are extinguished.

The general arrangement of the circuits of the standard totalisator is indicated in fig. 2, and the fact that its operation

Fig. 4.—Central Control Board.

is dependent on well-proved Strowger automatic telephone exchange components is a sufficient guarantee of the reliability and efficiency of its functioning. Furthermore, the extreme flexibility of the equipment due to the detachable unit method of assembly and mounting, not only renders it immune from breakdown, but facilitates its universal application and maximum service in any given area.

The R.B.C.B. standard totalisator, as supplied by the British Thomson-Houston Co., Ltd., and Automatic Telephone Manufacturing Company, Ltd., is covered by world patents.

Aylesbury's Rural Area.

Impressions of a Tour of Inspection, and Brief Particulars of New Bulk-supply Switchgear.

EARLY on the morning of January 30th members of the Municipal Council and the Electricity Committee of the Borough of Aylesbury set out on a tour of inspection of their rural electrification area, which part of Buckinghamshire

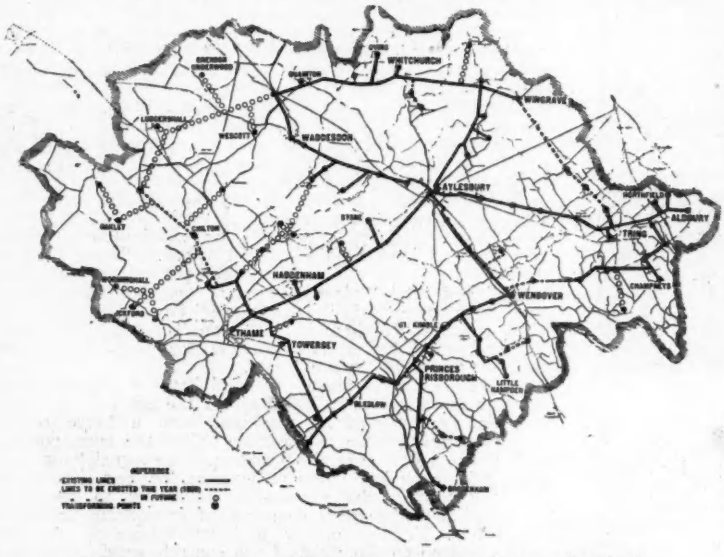


Fig. 1.—Aylesbury Electricity Supply Area; showing Overhead-line Routes.

the Electricity Commissioners had hoped and intended to select as the site of their experimental rural electrification demonstration area, before circumstances dictated the choice of a Bedfordshire locality.

Considering the comparatively small size of the municipality, its electricity supply area of 250 square miles is a large one, and the energetic borough electrical engineer, Mr. W. A. Turnbull, Wh.Ex., M.Inst.C.E., M.I.E.E., has proved his policy to be productive of concrete results. He is a pioneer in the electrification of the countryside, and realised from the outset the necessity of restricting capital expenditure to the absolute minimum; indeed, rather than spend too much money he has been known on occasion to go out and erect overhead-line poles himself.

The rural electrification scheme was embarked upon in 1926 and during the intervening four years it has involved the expenditure of £72,000, while the measure of success achieved is revealed by the facts that in the area no less than 49 villages and hamlets now have supplies of electricity available, and that the revenue derived therefrom has already reached £1,800 per annum, excluding town supplies and the Chinnor cement and lime factory, which is the undertaking's largest individual consumer and is electrically-driven and lighted throughout, fed electrically by two separate overhead lines at 11,000 volts.

The accompanying map (fig. 1) indicates the line routes, which it will be noticed form rings, and they will eventually form an outer ring round the periphery of the area and feed inwards, similar to the spokes of a wheel, with Aylesbury as the hub. All the lines are of the simplest character, and carried on single wood poles; the h.p. feeders operate at 11,000 volts, a single cross-arm carrying two conductors with the third on top of the pole, mounted on brown porcelain pin-type insulators. The step-down transformers are mounted on H-poles, being connected to the incoming feeders through lightning coils, silver-wire fuses, and plain air-break isolating switches operated by hand rod-lever from the ground level. The three l.p. (240-volt) outgoing distributors leave the transformer through fuses and are carried on "Aylesbury" poles, in which three holes are drilled vertically above each other to accommodate bushing-type insulators through which the conductors are threaded. A large mileage of both the h.p. and l.p. conductors consists of high-tensile steel wire, galvanised and stranded, the use of which is claimed to enable the lines to be erected at a cost of about £50 per mile.

The tour of inspection indicated the steady progress that has been made with the work since our last visit.* Proceeding by road from Aylesbury, the party first noticed a steel kiosk into which an underground cable from the generating station enters, thence emerging down the Vale Road where it reaches the overhead line in the rural area. Travelling to Bierton, the next village inspected was Rowsham, then round Wingrave and back to Aston Abbots, and on to Weedon and Hardwick; the two last-named villages will have supplies available this year. A good example of overhead distribution was witnessed at Whitchurch, with its pole-mounted step-down transformer. The route continued through Oving, Pitchcott (where line-erection work is in progress) to Quainton, a difficult village to erect overhead lines in on account of the numerous angles and P.O. telephone lines which had to be negotiated. From Long Crendon, Waddesdon Manor was reached, where a sub-station was inspected: it contains switchgear, a transformer, motor-generator, and an oil-engine-driven generator, with a battery room adjoining; thus a.c. and d.c. are available with three sources of supply for the fire-pumps and lighting, which were considered necessary for the protection of the valuable contents of the mansion and stud farm and racing stables on the Rothschild estate.

At Thame an excellent luncheon was enjoyed, the afternoon drive being through Towersey, which has recently been switched in, to the Chinnor cement works; thence through Bledlow, Bradenham, Lacey Green and Loosley, where line erection is now proceeding, and on to Princes Risborough, where are water works near Askett that have been built on the principle that it is cheaper to transmit electricity than water; several small electrically driven pumping stations are being established as and when needed to operate entirely automatically, functioning only when the pressure of the water falls to a pre-determined figure.

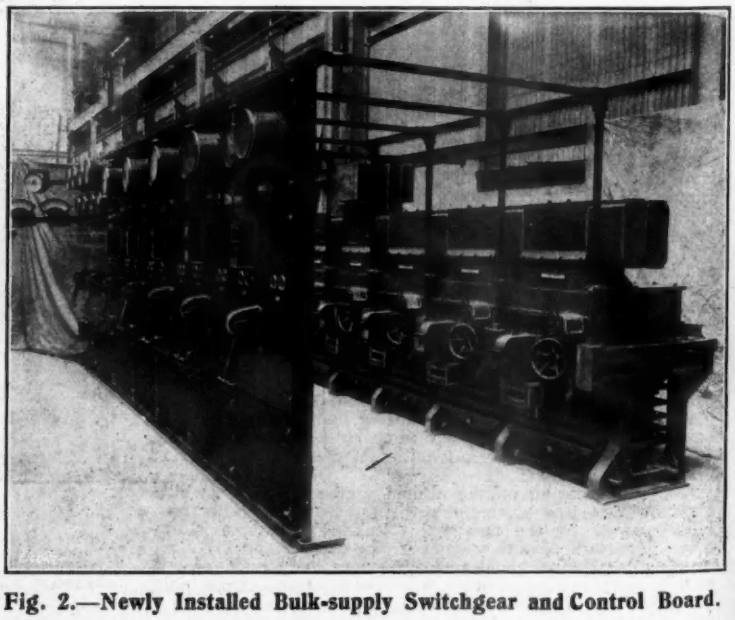


Fig. 2.—Newly Installed Bulk-supply Switchgear and Control Board.

On the return journey the party drove through the grounds of "Chequers," the Prime Minister's county seat, through Butlers Cross, Wendover, the Halton Royal Air Force camp, and Ashton Clinton, reaching Aylesbury about 5 p.m.

* Elec. Rev. July 22nd, 1927, p. 135; July 13th, 1928, p.83: and November 2nd, 1928, p. 764.

The generating station, having started with gas-engined d.c. sets and later installed a.c. steam turbo-generators, is now preparing to receive energy in bulk from the South-East England portion of the national grid by way of Luton, Beds.* The new 11,000-volt switchgear has been supplied by Messrs. Switchgear & Cowans, Ltd., at a capital cost of £1,382, and consists of seven panels (fig. 2, page 270), two of which have been provided by the Central Electricity Board. It will be recognised as the metal-clad, compound-filled, internal-isolation type, which is factory built in self-contained units and so designed that any number can be grouped to form switchboards of any size, the component parts being interchangeable. An unusual feature is the incorporation of an isolating carriage with the breaker contact pieces, as described and illustrated fully below and on the following page.

* ELEC. REV., October 7th, 1927, p. 604, and February 24th, 1928, p. 326.

Internal Isolation Switchgear.

An Account of the Equipment evolved by Messrs. Switchgear & Cowans, Ltd.

THE evolution of internal-isolating switchgear is a story of perhaps more than usual interest, and the following account of the product of Messrs. Switchgear and Cowans, Ltd., will, we believe, prove useful to our readers.

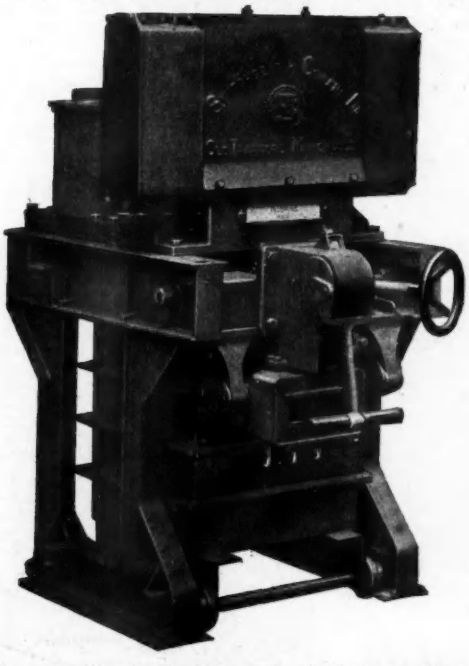


Fig. 1.—Single Bus-bar I.S. Switchgear Unit.

In the new S. & C. switchgear the circuit breaker remains in the same position, stationary on the floor, whether connected to or isolated from the line. As the breaker is neither moved horizontally nor raised or lowered vertically, all the heavy gear and framework for these purposes are eliminated.

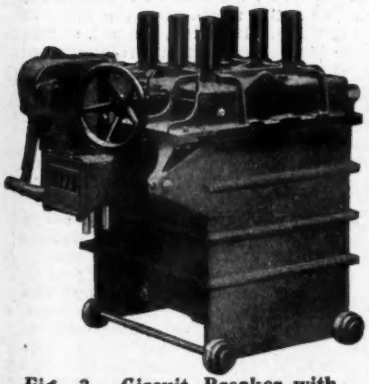


Fig. 3.—Circuit Breaker with Isolation Carriage Raised.

Fig. 1 shows a complete unit of 250,000 kVA rupturing capacity, depicting the great reduction in size and weight which has been effected. All the components are metalclad, self-contained units which can be easily removed and inspected. When it is necessary to inspect the breaker contacts the breaker is pulled out on its wheels along the floor.

The vital component of internal-isolation switchgear is the moving isolating carriage, which is arranged to move up and down within the breaker tank, as shown in the sectional view in fig. 2. The six terminal stems of the breaker, instead of

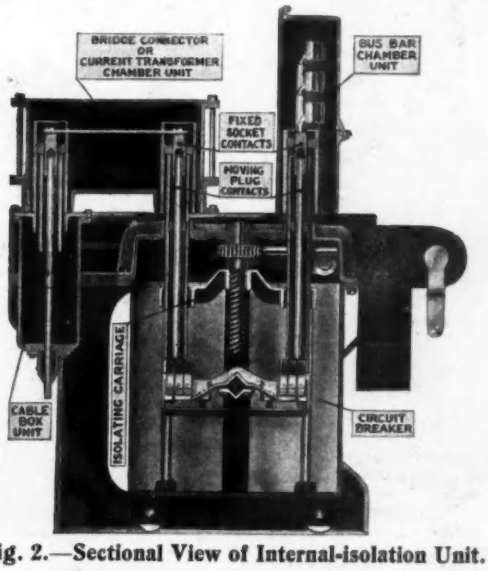


Fig. 2.—Sectional View of Internal-isolation Unit.

being fixed to the breaker top plate, are mounted in insulating shrouds fixed to the isolating carriage. The terminal stems are thus employed in a dual capacity, their lower ends forming the circuit breaker fixed contacts in the usual manner, and their upper ends forming the isolating plug contacts. These six plug contacts make and break connection with a group of six fixed terminal sockets. Three of these socket contacts are connected to the three busbars, and each of the other three socket contacts is connected through a bridge connector (or a current transformer) to the incoming cable. When isolating from the line the breaker remains stationary; the only part that is moved is the isolating carriage with its

Fig. 4.—Switchboard for Consumers' Sub-station.

plug contacts. Simply raising or lowering the isolating carriage inside the breaker tank by means of a handwheel outside connects the breaker to or isolates it from the line.

When the isolating carriage is raised to connect the breaker to the line, the plug contacts project through the breaker top plate and make connection with the fixed-socket contacts, and when in this position, the breaker can be operated, closed and tripped, just as if the terminal stems were permanently fixed to the top plate of the breaker. It is obvious that the switchgear is self-interlocking. The sequence of operations are inherent and simple, no intricate system of complicated interlocks being necessary. When connected to the line, the breaker cannot be pulled out against the natural interlock of the plug contacts extending up into the fixed-socket contacts. When the breaker contacts are closed they prevent the isolating carriage from being moved down; the breaker must first be tripped. The main circuit cannot be made or broken at the isolating contacts, but only at the breaker contacts under oil. When withdrawn, the breaker cannot be pushed home into position with the contacts closed, as the plug contacts are then projecting above the top plate. To take any strain off the gear, these natural interlocks are supplemented by two simple interlocking bolts.

In fig. 3, which shows the circuit breaker withdrawn for examination, the isolating carriage has been raised to its top position, so that the isolating-plug contacts are projecting through the top plate. The breaker can only be inserted with the isolating contacts lowered, and then, to connect the breaker to the line the isolating contacts are raised into the position shown.

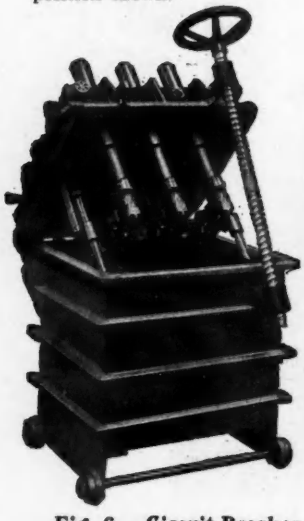


Fig. 6.—Circuit Breaker Opened for Inspection.

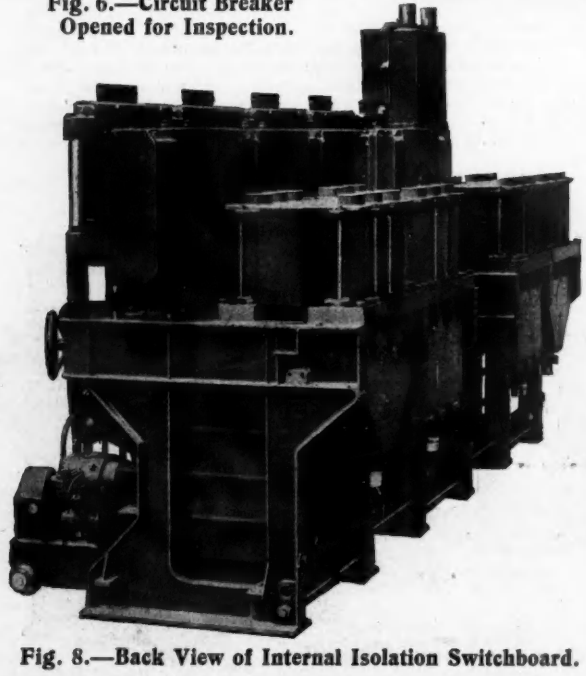


Fig. 8.—Back View of Internal Isolation Switchboard.

When duplicate bus-bars are required, bus-bar selection is efficiently obtained by utilising the circuit breaker as a selector switch. The only addition required is a duplicate set of three fixed-socket contacts connected to the cable box terminals, while the circuit breaker is arranged to occupy two positions, each set of three bus-bars having, of course, its own set of three socket contacts. By this means it is possible promptly to change over from one set of bus-bars to the other by simply moving the circuit breaker on its wheels backwards or forwards a few inches, the plug contacts on the isolating carriage connecting one or other set of three cable socket contacts to one or other set of three bus-bar socket contacts.

In view of the fact that the isolating carriage is incorporated in its design, the circuit breaker is of special interest, particularly so because of the ingenuity with which this has been accomplished. The top plate of the breaker is hinged, and lugs are provided on the top plate and on the tank for attaching a simple screw jack. After removing the bolts in the top plate, a few turns of the handwheel on the jack swings back the top plate, and the breaker contacts are fully exposed for examination, fig. 6. The complete operation of isolating, withdrawing and opening the circuit breaker takes only a few minutes and is done in perfect safety.

Fig. 5.—Circuit Breaker Opened: Isolating Carriage Lowered.

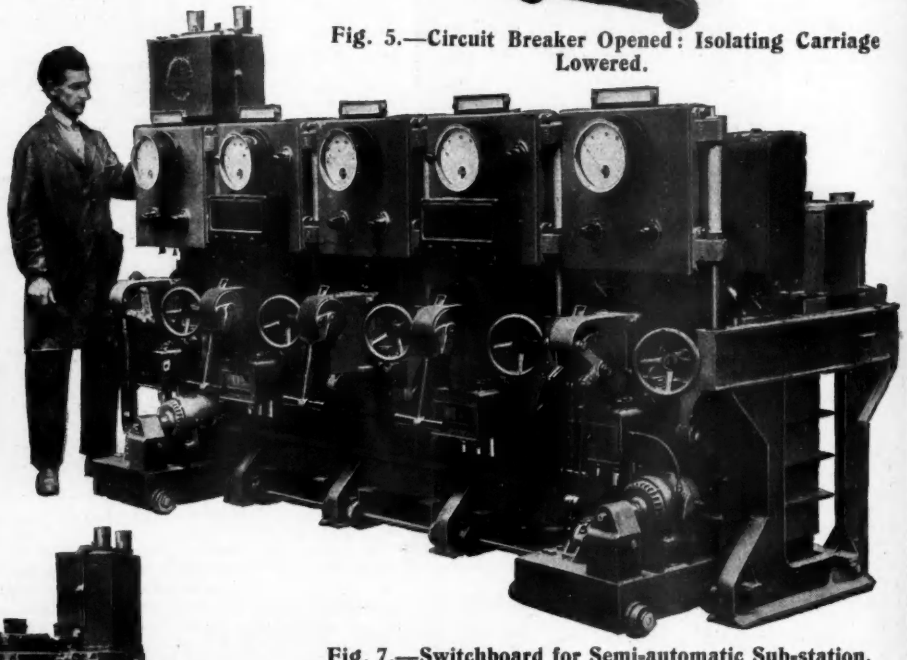


Fig. 7.—Switchboard for Semi-automatic Sub-station.

In fig. 5, the isolating carriage has been lowered to show how it carries the terminal stems fixed in bakelite shrouds. When the top plate is opened up, the circuit breaker can be opened and closed, facilitating adjustment of the moving and fixed contacts.

Figs. 4 and 7 are of two types of switchboards formed of internal-isolation switchgear units as installed in sub-stations on the grid. The board shown in fig. 7 is installed in a semi-automatic sub-station, and comprises two incoming split-conductor feeder panels, one bus-bar coupler panel, and two rotary-convertor feeder panels with automatic, remote-controlled, motor-operated circuit breakers. The instruments are mounted on hinged panels, the hinge mounting forming the conduit for the small wiring. Fig. 4 illustrates a four-panel board installed in a consumer's sub-station, and comprises one incoming feeder panel, one metering section, and two panels controlling distribution circuits through transformers.

How each switchgear unit is built up of metalclad, self-contained, components is shown in fig. 8, which is a back view of a switchboard showing the arrangement of the potential transformer, bus-bar chambers, current transformers or bridge connectors, and cable boxes; each metalclad component is easily accessible and can be removed and replaced individually.

Electricity Supplies to Large Buildings.

The need for the co-ordination of the various rules and regulations to which large installations in London have to conform.

(*Report of an* E.P.E.A. TECHNICAL GROUP *Meeting.*)

AT a recent meeting of the London Local Technical Group of the Electrical Power Engineers' Association, Mr. W. J. Jeffery, A.M.I.E.E., presented a paper on the regulations affecting the supply of electricity to large buildings, theatres, &c., which gave rise to a recommendation by the meeting for further consideration of the subject with a view to effecting some co-ordination of the many regulations which exist.

The chair was occupied by Mr. J. H. C. Brooking.

The regulations governing the supply of electricity to large buildings were placed by the author in six groups, as follows :—

(1) Those of the Electricity Commissioners, under the Electric Lighting Acts.

(2) The Home Office Regulations, under the Factory and Workshops Acts.

(3) The regulations of the various electricity supply authorities, which were based primarily upon the first two groups, with the addition of special clauses dependent upon the local conditions of the undertakings.

(4) The regulations of the various licensing authorities for theatres and other places of public resort.

(5) The Regulations for the Electrical Equipment of Buildings, formerly known as the I.E.E. Wiring Rules.

(6) The regulations of the fire insurance offices.

Generally, the Electricity Commissioners' Regulations applied to electricity supply undertakings, and contained few clauses relating to buildings to which supplies of energy were given, those clauses being framed with a view to ensuring the safety of the public. The Home Office Regulations applied to factories and workshops, and had been responsible for the development of more satisfactory types of apparatus for use in installation work.

Section 26A of the Commissioners' Regulations provided that a suitable safety fuse or automatic circuit breaker should be inserted as close as possible to the point of entry. In view of the size of services now frequently run in, the author regarded the substitution of the circuit breaker for the fuse as a very desirable development, almost the only hindrance to which was the difference between the costs of the two pieces of apparatus. It was extraordinary, he added, how widespread the effects of a short circuit on consumers' premises could be when installations were protected only by fuses. Several undertakings were adopting circuit breakers; what was the lowest limit of size adopted for this purpose?

Another point of vital interest in the same regulations was the rule that fuses, &c., should be fixed as near as possible to the point of entry, which led him to comment upon the urgent need for educating architects and property owners to the necessity of housing electrical apparatus decently. The fact that they were averse from allocating suitable intake chambers for electricity services gave rise to many difficulties. A service was expected to come into a building either through the coal or coke cellar, in which case it frequently had to be extended for a considerable distance into the building before a suitable position could be found to terminate the service and install cut-outs, meters, switches, &c.; or, alternatively, the service came into the lavatories, with results not satisfactory to electrical apparatus. All concerned should realise that modern buildings could not be run without electricity, and he urged that electrical installations should not be treated as additions to, but as very essential parts of, the buildings, just as important as the floors and stairs.

A very frequent source of difficulty arose from the many slipshod methods of installing conduit in buildings. Although the supply authority might state that the I.E.E. Wiring Regulations were to be adhered to, the inspector of the undertaking sometimes found that such poor slip joints had been made that it was certain there was no mechanical or electrical continuity of the conduit. It seemed necessary then for the authority to defend its action, if it refusd to connect, basing its refusal on Sub-Section 5 of Clause 27 of the Electric Lighting (Clauses) Act, 1899, which provided that a "supply shall not be given unless the lines, fittings, and apparatus are in good order and condition and not calculated to affect injuriously the use of energy by the undertakers or other persons." Did that mean that so long as the general supply outside the building in question would not be affected a service supply must be given?

The regulations concerning installation were the logical development of the various regulations drawn up by the fire insurance companies, some of which were excellent, but could now be considered to have been superseded by the I.E.E. Regulations. Generally, none of the latter had been more completely neglected than paragraph 94F, which provided that in the case of installations in which the normal working current in any circuit, or circuits, connected to the main distribution board exceeded 100 amperes there should be provided, in addition to a fuse, or circuit breaker with overload trip, an automatic device whereby the installation, or faulty circuit, as the case might be, would be disconnected in the event of a leakage to earth; and that the said device might be set to operate with any prescribed value of leakage current, provided that such value did not exceed 100 amperes. That Regulation seemed to be most valuable, but very few people seemed to be aware of its existence, and some had stated that it was impossible to carry it out on a d.c. system. A few manufacturers had developed apparatus to do what was needed, but had found that there was practically no demand for it. At the same time, the G.P.O. engineers had put such apparatus into standard use, and deserved credit for so doing. The adoption of such apparatus involved the use of circuit breakers, and the only objection he could see to its adoption was that of price. In recent discussions in the Press it had been questioned whether it was worth while adding a piece of apparatus of that type, and whether more perfect bonding would not overcome the difficulty. That argument pre-supposed that the development of a fault was necessarily rapid, but frequently that was not the case. Depending upon voltage and local conditions, faults might remain for a long time, carrying sufficient current to introduce a serious fire risk without developing sufficiently to cause the circuit fuse to blow. An important point was the relation of the size of such a circuit, with its possible fault current, to the normal fault current in the system.

Rule 126A (*d*) provided that the h.p. conductors should conform in all respects to the appropriate British standard specification when a step-up transformer was used for raising the pressure of supply, but he doubted whether it was sufficient to deal with the high-pressure mains used to supply neon signs. In such cases the h.p. mains might be run in screwed conduit up through a building and conform, apparently, with all regulations, and yet might be a potential source of danger owing to the inability of a workman, who might be carrying out repairs or alterations to the general wiring system in the building, to discriminate between the various conduits. It seemed that the Regulations could be stiffened up, or perhaps the matter could be dealt with more suitably in the Commissioners' Regulations, having in view the Commissioners' statutory powers to enforce them.

Again, although Rule 123H provided that in the case of water-heating apparatus the water should not be in direct contact with the live portion of the heating element, the development of thermal storage had introduced boilers heated by 3-phase current at pressures up to 11,000 volts in which the heating was effected by immersing c.i. electrodes direct in the water, directly in opposition to the rule. Various large installations had been equipped in that manner. It was not suggested that development should be hampered by the strict enforcement of the rule; it was much more likely that a carefully considered exemption clause would have to be drafted, leaving the existing rule to cover the smaller and lower-pressure domestic apparatus.

The London County Council Regulations concerning electricity supply to places of public entertainment were in many respects comparable with those concerning electricity supply in mines, which in their turn were the most stringent regulations in operation. The L.C.C. Regulations asked for two entirely distinct systems of lighting for all parts of buildings to which the public had access. That was an excellent provision, but as it permitted gas, oil, or candle lamps to be used as one of the systems it did not appeal to electrical engineers. Rule 80 (Section *e*) provided that the I.E.E. Regulations should be complied with, except that only Class R (armoured cables), Class T.1 (conduit screwed), or Class T.2 (metal conduit not screwed) should be used in the wiring systems. It debarred the use of lead-covered and c.t.s cable, unless run in conduit, and there was an apparent divergence of opinion between the authorities responsible for the two sets of regulations. In a recent letter to the Press concerning a fire in premises at Smethwick whereby eleven persons had lost their lives, and in connection with which a witness had condemned the use of lead-covered rubber-insulated cables for wiring public buildings, the Council of the I.E.E. had re-affirmed its opinion that lead-sheathed cables were both suitable and safe for electrical installations if installed and maintained in accordance with the I.E.E. Wiring Regulations.

Commenting on the L.C.C. Rule that wiring must not be run in lift shafts or ventilating ducts, he said that the sooner definite and suitable conduit routes were provided in all buildings the better.

Another rule was that electric radiators should be installed only in approved positions, and must be provided with guards at least 6 in. from the elements. That was a direction in which most radiators might well be improved. He welcomed also the rule that gas and water pipes must be excluded from electricity intake rooms, and that those chambers must be of adequate size, constructed of fire-resisting materials, and ventilated to the outer air.

Finally, he pointed out that the L.C.C. Regulations prohibited the use of twin-twisted flex-cords without protection, except for pendant and portable table lamps, whereas the I.E.E. permitted its use for fixed wiring, fixed fittings, &c. Having seen recently a shop window in which flex for lighting was securely fixed to the window frame with what appeared to be ordinary drawing pins inserted between the two flexes, it seemed to him that there was much to be said for the L.C.C. restriction.

Discussion.

Mr. ARTHUR E. DREW said that the I.E.E. Regulation concerning the provision of leakage protection on circuits exceeding 100 amperes and the earthing of the neutral point on consumers' premises were very closely related. A number of excuses had been made for not carrying out the Regulations; people had said that the necessary apparatus was not available, and that they did not see the need for it, for the circuit fuses could be relied on to remove a fault. Experience had shown, however, that circuit fuses were not of much use in some cases. The necessary apparatus did exist, but the greatest snag was that one could not provide leakage protection unless some part of the circuit was earthed, so that before one could carry out the regulation some decision must be come to with regard to earthing. The authorities in New Zealand were insisting, not only on the protection of circuits exceeding 100 amperes, but also of practically all circuits, and he believed they limited the rating of the circuit breakers to 5 amperes. There were circuit breakers that operated at as low a current as 5 amperes and it seemed that if the demand were sufficient such breakers could be supplied quite cheaply, probably at something less than £1 each.

Mr. A. F. HARMER emphasised the difficulty of obtaining adequate sites for transformers in buildings, and said that one of the greatest bugbears was the curious attitude of architects, who appeared to think that one could put a 300-kVA transformer in the space previously occupied by an ordinary five-light gas meter.

Mr. A. G. HILLING urged that the Institution of Electrical Engineers might with advantage approach architects with a view to impressing upon them the necessity for providing adequate intake chambers.

Mr. HARMER said the Institution had tried to do so.

Mr. HILLING replied that it ought to try again, because the small space, about 3 ft. square, usually provided by the architect in large buildings, was not sufficient.

A speaker, after commenting upon the difficulty sometimes experienced in interpreting various regulations owing to the curious wording adopted, said he had had many interviews with L.C.C. authorities and they had always stated quite clearly that every job would be considered on its merits. It was well that that should be known. He mentioned a case in which some outside wiring had been done with c.t.s. cable and, although that was strictly against the L.C.C. Regulations, the work was so well done that it was allowed to remain. The Middlesex County Council Regulations relating to large buildings were just about as strict as those of the L.C.C. Certain regulations, he added, applied only to buildings having a seating capacity of over 500, and he had often been asked why it was that less care should be taken to protect the lives of the first 499 people than those of 500.

Another speaker said that his difficulty was not so much one of interpretation as of obtaining the agreement of the different authorities as to what was satisfactory, because it was extremely difficult to get them to make a pronouncement on any difficult matter until the work had been done, and then it was often condemned. Installation work which was regarded in one district as sound was considered to be unsatisfactory in another. Cab-tire-sheathed installations were accepted in the majority of situations as meeting the regulations, whereas occasionally such an installation was condemned in a very arbitrary manner, indeed without any satisfactory reason being given. It was incumbent upon the industry as a whole, therefore, to set its house in order and see that definite rules were complied with, and that nothing unreasonable was demanded. He held that the introduction of an earthing wire into a building was a source of danger, because such a wire was always assumed to be in order and was never inspected after it had once been fixed; it might become disconnected or broken without anyone being aware of the fact. It seemed to him that in a 230-volt system with the centre point earthed, the earth wires should be one side of the circuit. If the return circuit were the earth wire, unless the latter was in good condition the circuit could not operate. There was a great divergence of opinion, but the matter must be settled once and for all.

Mr. MORLEY said that probably the majority of the small faults on consumers' circuits which caused large disturbances in the areas of supply and brought out circuit breakers at substations two or three miles away could be cured by the use of circuit breakers on consumers' premises, but he had yet to see an efficient and cheap small circuit breaker which could not be tampered with by consumers. He had known small circuit breakers to be installed, but they had not come out when they should have done, and it had been found that they were well tied up and of no use whatever. It seemed, therefore, that unless there were on the market some new type of circuit breaker, of which he was not aware, the fuse was safer.

Mr. W. F. ANDREWS (hon. secretary of the group) asked why the L.C.C. did not always stick to its own rules with regard to the provision of proper spacing between the points of entry of gas, water, and electricity mains into buildings. In blocks of workmen's dwellings erected by the L.C.C. to house hundreds of people the mains entered within almost a few inches of each other. The rules to which he had referred applied to public buildings, and perhaps blocks of flats were not in the same category. He had also noticed that very little space was available for installing the main circuits. He agreed that it would be advantageous to have only one set of regulations relating to public buildings, which would be binding on the whole industry, because under present conditions one never knew exactly one's position; one might have to satisfy either the L.C.C. or the Home Office, or both, and when they had been satisfied, probably the consumer would refuse to pay the bill.

The CHAIRMAN said that the I.E.E. Rules were not so severe as others because they had regard to the pockets of individual consumers, whereas the other regulations affected everybody else's pockets; a house-owner would not have an installation at all unless its price was reasonable. Other regulations were more severe than those of the I.E.E. because they legislated, not for the safety of the few inhabitants of each individual house, but for the safety of people in bulk. Individuals, and particularly officials, based their opinions with regard to cab-tyre-sheathed cables on their own experience, or on what somebody else had told them. If a man had dealt with a firm which had made such cables for many years and knew how to make them properly he would back them for all he was worth, but if he had dealt with a firm which did not make them in accordance with the best practice, so that they were not efficient, he was biased against them. With regard to the desire which had been expressed by some speakers for the co-ordination of the existing rules, he suggested that the meeting might care to express an opinion with regard to it which might be referred to some competent body for consideration, so that eventually the position might be clarified.

Dr. ALLAN supported the chairman's suggestion and urged that one set of rules only was needed. Referring to a.c. supplies to consumers having transformers on their own premises, he understood that the consumer could elect to earth or not. It seemed to be entirely wrong, however, that it should be at the discretion of the consumer, because the supply authority was responsible for maintaining a good supply and, therefore, should be responsible in every way for the operation of the whole scheme. He had seen plans of an American concrete building which included the provision of ducts below the level of each floor for the purpose of carrying the services.

Mr. W. F. ANDREWS said his supply authority had ruled that the switches, lampholders, &c., installed in bathrooms on the Council's housing estates must be of insulated materials.

A speaker believed the North Metropolitan Co. also insisted upon the use of insulated switches, lampholders, and so on, in bathrooms.

Mr. DREW said that the War Office authorities had adopted cab-tire cable as the standard for wiring buildings.

A speaker suggested that, if small circuit breakers were used on consumers' premises, the insurance companies might be prepared to rebate a percentage of those consumers' insurance premiums in consequence. If, as Mr. Drew had hinted, it were possible to obtain such circuit breakers for less than £1, then a small rebate on insurance premiums would in time cover the cost.

Mr. MORLEY believed the I.E.E. Rules covered such apparatus as switches and lampholders in bathrooms, but did not think there was a rule covering the use of flexibles, though it would appear that the latter were the greatest source of danger in bathrooms.

Mr. JEFFERY, replying to the discussion, said that the object of the paper was to call attention to the fact that electricity supply to large buildings was governed in such areas as London by half-a-dozen sets of regulations, and to the difficulties which arose as a result. A manufacturer had told him a few weeks ago that he had received an inquiry for the supply of the largest number of circuit breakers he had ever been asked to quote for. The inquiry was from an undertaking abroad which wanted to buy many thousands, the majority of them for currents under 50 amperes, which indicated the development that had been effected abroad. He did not quite agree with the opinion that architects were quite hopeless from the point of view of providing proper facilities for electrical apparatus in buildings, for during the last few years he had noticed that they were beginning to appreciate the position, and in certain directions things had become more satisfactory than they had been hitherto. In that connection he called attention to the clever move made by the Electric Lamp Manufacturers' Association in attaching an architect to the staff in its lighting bureau at Savoy Hill, London. He was a fully qualified architect, and was able to put forward in architectural circles the views of the electrical industry. The various electricity supply undertakings might with advantage group together and employ architects in a similar manner. The L.C.C. rules to which reference had been made by Mr. Andrews did not apply to flats. As to the desire for the co-ordination of rules, he

gathered it was not the intention to ask for the setting up of any new body, but that the Electricity Commissioners should be asked to consider the standardisation, or grouping, of the various rules. The I.E.E. Rules did cover fittings in bathrooms to a limited extent by providing for the earthing of exposed metal parts, and also for placing them beyond the reach of a person in the bath. With regard to the suggestion that insurance companies might allow rebates when circuit breakers were used, he said that, inasmuch as the electrical industry was trying to prove to insurance companies that all electric wiring was perfectly safe, it would be rather difficult to prove that some electric wiring was safer than others.

After some discussion the meeting made a recommendation to the Transmission and Distribution Committee of the London Technical Group of the E.P.E.A. that the existence of too many sets of regulations concerning electricity supply to public buildings led to confusion, and that the matter should be considered and, if thought fit, representations as to the desirability of co-ordination should be made to a competent authority.

Factory Illumination.

Some aspects of industrial lighting, which is more generally inadequate in the Midlands than is realised.

(*Extracts from a lecture before the* ILLUMINATING ENGINEERING SOCIETY.)

A LECTURE on the above subject was recently delivered before a special meeting of the Illuminating Engineering Society in Birmingham by Mr. E. A. R. Werner, O.B.E., M.A. (H.M. Superintending Inspector of Factories for the Midland Division), who, in the course of his remarks, said that two advantages of good lighting which were fairly obvious on first principles were :—

(*a*) It engendered confidence in the *personnel* of the works; it removed the constant apprehension of minor accidents (apprehension which in extreme cases may prove a very real handicap to the proper flow of work in a factory). Motorists would at once recognise the feeling he described as apprehension, which seized a driver when he suddenly found himself approaching a dark patch in the road; he could not drive into that patch with any confidence until he had peered into it and made sure that there was not some unlighted person or thing in front of him. He believed exactly the same apprehension (possibly in a minor form) seized any worker who had to pass through a really badly lighted patch in a works; he hesitated until he had satisfied himself that there was nothing there which he would trip over.

(*b*) The cheering and stimulating effects of bright surroundings. No one had yet analysed the tonic effect on the public of the ever-increasing illumination of a great city, but everybody sensed it as a common advantage. It might well be that increased light helped to disperse some of the depression caused by economic gloom.

Statistics proved that for three successive years about 700 deaths occurred annually from industrial accidents reported from a group of 80,000 works, the incidence of accidents being greater in the darker months of the year; in other words, more light meant less accidents. Many other sets of statistics which pointed to a similar conclusion had been tabulated. One large insurance company estimated that in 1910 some 23.8 per cent. of the accidents dealt with by it were due to imperfect lighting; that percentage was reduced to 18 per cent. as the result of eight years' concentration on the improvement of lighting wherever possible. Industrial accidents involved a very serious financial burden on industry, and the prevention of industrial accidents due to faulty lighting was, therefore, amply justified on economic grounds alone, besides being desirable in the interests of humanity. Statistics had also been collected to show the effect upon output.

"Brightness" was measured by the amount of light returned from a surface, and was a most essential factor in industrial work, since the power of seeing depended on the light returned from an object to the eye. The brightness of a surface depended, not only on the amount of light received by it, but also on its capacity of reflecting the light received; it was important to take that factor into account when the work in hand involved the use of different kinds of material. For example, white material would reflect about 80 per cent. of the light it received, so that an illumination of 5 foot-candles would give an effective brightness on the work itself of 4 foot-candles. A fairly dark yellow often reflected only about 40 per cent., and hence the same 5 foot-candles would only give an effective brightness of 2 foot-candles. Black material only reflected about 0.8 per cent., so that the same illumination would only give 0.04 foot-candle of effective brightness. The essential points in good lighting had been outlined in the reports of H.M. Departmental Committee on Lighting in Factories and Workshops.

Having provided means of lighting which would give at all points an adequate amount of illumination, it was necessary to take steps to avoid certain defects. The most serious was glare, which caused dazzling and the temporary impairment of vision, so materially increasing the risk of accident. Even minor forms of glare were a handicap and might cause a certain amount of distraction and even irritation; workers might acquire the habit of not looking up at unshaded light, and yet they might be receiving sufficient oblique rays to constitute a definite handicap; it was believed that that was a very common state of affairs, and his reason for laying some stress on it was that it so often went unnoticed when more obvious defects were recognised and remedied. The Home Office Committee paid much attention to the subject and concluded that sources of brightness which did not exceed 5 foot-candles per sq. in. could safely be exempted from all restrictions, as conforming approximately to the brightness of the sky.

Reflected glare was a potential trouble which arose when work had to be done on bright or polished surfaces. The workman's trouble from reflected glare was analogous to the discomfort experienced by a motorist who had to drive towards the sun when the latter had emerged from clouds after a shower of rain; the vizor of the car, or the peak of his cap, might protect the driver from the direct rays of the sun, but he could not escape the rays reflected by the wet and shining surface of the road. Reflected glare in a factory could generally be obviated by altering the lateral angle at which the light impinged on the work.

Shadows which prevented the working surface from receiving the maximum available illumination should, of course, be avoided. "Standing in one's own light" was an expression, frequently used in a metaphorical sense, which had acquired a sinister meaning, yet any number of men were to this day compelled to stand in their own light literally whilst they were at work. Moving shadows were most harmful, because they produced flickering illumination.

Insufficient illumination appeared to be much more widespread in the Midlands than most people realised. The standard in general engineering shops was low; almost 50 per cent. of the works wherein tests had been made had standards of illumination which were below the economic minimum. Electrical engineering works, however, generally had a good standard. In cycle and motor-cycle works no less than 76 per cent. were below a 5 foot-candle standard; woodworking shops, 98 per cent. below; silk-ribbon factories, 74 per cent. below; and many were even below a 3 foot-candle standard. In many cases there was no light at the backs of looms; workers who had to go to the backs of the looms stated in some cases that they had developed the sense of touch because they could not see what they were doing; in other instances, it had been found that they had put up sheets of white paper to give them a little reflected light. Among the less fine trades carpet factories had generally a fairly good standard; 66 per cent. of those investigated were above the 3 foot-candle standard; the daylight blue type of electric lamp was being used to an increasing extent in that trade, and its use was also growing in general engineering works. Boot and shoe factories in the Midland area had a good standard, only 7 per cent. of the readings taken being unduly low; 60 per cent. had a good average; and 33 per cent. had over 20 foot-candles.

The maintenance of lamps, globes, and reflectors needed more attention, especially where there was any dust or dirt which was likely to settle on the reflectors. With regard to the positions of lamps, there was still a good deal of room for improvement. The light should be well diffused over the whole of the working area, so as to minimise the interference of objectionable shadows.

In conclusion, the lecturer pointed out that most workers were employed during many more hours of daylight than of artificial light and, however good gas or electric systems might be, daylight was admittedly superior to them. Under those circumstances, it was somewhat astonishing that such poor use was often made of natural illumination. Probably more factory windows were cleaned nowadays than ever before, but even so, one would probably be justified in saying that regular and efficient window cleaning was the exception rather than the rule. It had been pointed out that even slight dirt on the windows might obstruct as much as 50 per cent. of the light. The advantage of introducing daylight at a relatively high point was beginning to be more generally recognised; until recent years it was unusual to see windows carried right up to the top of a room, but the great development of reinforced-concrete methods of building was tending to change that completely. The preference for single-storey factories, with a saw-tooth or similar roof, had led to a great development in roof lighting, with its attendant advantages.

Legal.

Oxford Corporation v. Oxford Electric Co., Ltd.

ON January 29th Mr. Justice Bennett in the Chancery Division delivered his reserved judgment in the case of the Corporation of Oxford against the Oxford Electric Co., Ltd., with respect to the acquisition by the Corporation of the company's undertaking and works. His Lordship said two questions had arisen between the parties which he was called upon to decide: first, what was the proper method of ascertaining the price which the plaintiffs had to pay to the defendants for the purchase of part of the defendants' undertaking; and the second what was the date from which the plaintiffs were entitled to the profits and that part of the undertaking which they were purchasing. By virtue of the Oxford Electric Lighting Order, 1890, the plaintiffs, on December 3rd, 1928, served on the defendants a notice requiring them to sell the undertaking. The parties being unable to agree how the price was to be ascertained, the plaintiffs issued a writ asking the Court to declare the true meaning of the section of the Order and for a decree of specific performance. The plaintiffs said that the purchase price was to be ascertained by capitalising a sum of five per cent. upon the capital shown by the books to have been properly expended on the undertaking upon the footing that that sum represented the annual net profit of the defendants' undertaking. The defendants said that the purchase price should be ascertained by capitalising the annual net profit of the undertaking upon a five per cent. basis. In other words, what was to be done was to ascertain what the annual net profits of the undertaking were and then to ascertain what was the capital sum which, if invested at five per cent., would produce those profits. Between these two contentions, said his Lordship, his judgment was in favour of the plaintiffs. There was no reason why the local authority should be interested in the capital of the defendants unless it were as possible purchasers of their undertaking and only then if the capital was to be a factor in the calculation by which the purchase price was to be ascertained. As to the date from which plaintiffs were entitled to the profits of the undertaking, plaintiffs claimed that the date was December 3rd, 1928, on which they served the notice on defendants. The defendants counterclaimed for a declaration that the profits would not belong to the plaintiffs until completion of the transfer of the undertaking and payment of the purchase price. The obligation of the defendants to sell the undertaking arose when plaintiffs gave them notice requiring them to sell, and it was an obligation to sell the undertaking as it existed at the date of the notice subject to all subsisting rights and contracts. It followed that from the same date plaintiffs must be entitled to the profits of the undertaking and they must be entitled to the benefit of the contracts the burdens of which were imposed upon them. The order he would make in the action would embody an appropriate declaration. Defendants must pay the costs of the action, and the counterclaim would be dismissed with costs. There would be liberty to apply as to the loose plant, stores, &c., of the defendants not in the area affected by the purchase.

Mr. TYLDESLEY JONES, K.C., for plaintiffs, said that when the matter again came before the Court on the form of the declaration to be granted he might propose that the questions to be settled should go before a special referee.

Mr. CRAIG HENDERSON, K.C., for defendants, said he might at the same time desire to ask for a stay of execution.

Electric Furnace Co., Ltd., v. Kelloyd Metals.

IN the Official Referees' Court on January 29th, Sir William Hansell, K.C., one of the Referees, had before him an action brought by the Electric Furnace Co., Ltd., Victoria Street, S.W., to recover £489, balance of the price of goods sold to Kelloyd Metals, the Palace of Industry, Wembley. The defendants denied liability and counterclaimed for £150 and for damages.

Mr. J. W. MORRIS, for the plaintiffs, said that the claim was based on the sale of an "Ajax-Northrup" reconditioned high-frequency induction furnace equipment. He explained that this equipment was devised by the plaintiffs, and by its means metals could be melted in a furnace, the heat being inducted into the metal by electric power. The process was an important improvement in the trade, the coils for melting the metals being applied to crucibles with good results. Defendants maintained that the process was not satisfactory. They based their counterclaim on the loss sustained by paying £150 on account and for damages for loss of profits owing to the equipment being unworkable.

Mr. THOMAS KELLY, a director of the defendant company, said that the furnace never acted satisfactorily in the mixing of the metals. The primary object was to melt tungsten, but the furnace failed to do it and would not even melt ordinary alloys without the use of a graphite crucible.

Mr. MORRIS, for plaintiffs, submitted that the furnace was never given a proper test.

SIR WILLIAM HANSELL, the Official Referee, gave judgment for the plaintiffs on both claim and counterclaim, considering that the defendants had never attempted to make proper use of the installation.

Lanarkshire Company's Rating Appeal.

THE Valuation Appeal Court, Edinburgh, on January 28th, before Lords Hunter, Sands, and Fleming, disposed of the appeal of the Lanarkshire Electric Power Co., Glasgow, against the value of £20,274 per annum placed upon its undertaking by the Assessor, who proceeded on the revenue principle. The appellants submitted that the annual value of £10,000 should be entered on the valuation roll. This figure was arrived at, the appellants stated, upon the application of the contractors' principle, their contention being that, in the particular circumstances of the company, with only one customer (the Clyde Valley Electrical Power Co.) for their electricity, the revenue principle was not the proper method of ascertaining the annual value.

The Upper Ward Valuation Committee confirmed the Assessor's valuation, and was of opinion that if the contractors' principle were the proper method, no cause had been shown for the deductions which the appellants made in order to reach the £10,000 which they suggested was the proper figure.

The Court dismissed the appeal. Lord Hunter said that so far as he knew the revenue principle had been adopted in connection with the determination of the annual value of all similar undertakings. It was maintained that there were special reasons applicable to the undertaking which necessitated the adoption of a different principle. The main reason seemed to be that a large part of the capital expenditure of the undertaking was connected with the harnessing of the water—the making of weirs, tunnels, and so on—at Stonebyres and Bonnington. The cost amounted to £205,000, and upon this the appellants contended that 5 per cent. should be taken and a deduction made of £10,000 from the valuation brought out on the revenue principle. His Lordship was unable to follow that. If the argument were rejected, and if the revenue principle fell to be applied the appeal failed.

Lords Sands and Fleming concurred.

False Trade Description on Batteries.

AT Middlesbrough Police Court on January 28th Thomas William Thomas, electrical dealer, 21a, Albert Mews, Middlesbrough, was fined £2 with £5 costs for having sold foreign batteries which were labelled "Made in England." The proceedings were taken by the Board of Trade, upon information supplied by the Ever-Ready Co. (Great Britain), Ltd., and the charge was that of having applied a false trade description to the goods.

An official of the Board of Trade stated that defendant sold German flashlamp batteries under the name of "Evergood," and bearing the label "Made in England."

The defendant submitted that the parts of the batteries were bought abroad and assembled by him at Middlesbrough. He bought the zinc tubes, the carbon rods, and the boxes, and the rest was made by himself. He pasted on his own label stating that the batteries were British.

The Stipendiary doubted if batteries made in that way could fairly be described as British. The defendant had done some small part in making them, but he could not see that that could be made to mean that the goods were not made in Germany. "The proceedings are conducted very largely by an opposition company in England," he added, "and I do not think the offence was very serious."

Parliamentary News.

[By our Special Parliamentary Reporter.]

The S. W. & S. Company's Bill.

The Bill deposited by the Shropshire, Worcestershire and Staffordshire Electric Power Co., contains provisions for the raising of a further £1,000,000 of capital and the increasing of borrowing powers by £500,000; and the extension of the company's area to include the borough of Stratford-on-Avon and the urban and rural districts of Bromyard and Ledbury, Herefordshire. The Bill also seeks to empower the Electricity Commissioners to sanction further capital increases by means of Special Orders, and there are a number of other provisions.

Brixham Gas and Electricity Bill.

The Bill which is being promoted by the Brixham Gas and Electricity Co. contains provisions for the reorganisation of the company's capital and the extension of its area of electricity supply to include the Broad Sands portion of the Paignton urban district.

The Marple Electricity Scheme.

On January 28th Mr. REMER asked the Lord Privy Seal if his attention had been called to the application of the Marple Urban District Council for financial assistance through the Unemployment Grants Committee in respect of a scheme of electricity supply within its area; if he was aware that the application was first made on September 5th, 1929, and that,

in spite of considerable correspondence, no decision had yet been communicated; and if he would take steps to see that this was dealt with.

Mr. THOMAS said it had not been possible to give an earlier decision in this case, because there was doubt whether the conditions of the grant had been satisfied, in particular the condition relating to acceleration. The Unemployment Grants Committee had now decided, on the information before it, that the work was sufficiently accelerated for a grant to be given, and the authority had been so informed.

The Battersea Power Station.

On January 29th SIR KINGSLEY WOOD asked the Minister of Transport whether he could state the present position in relation to the Battersea power station; and whether any further report had been made by the Government chemists.

Mr. HERBERT MORRISON said that the Government chemists had not been in a position to furnish any further report, but he understood that a further series of experimental tests had been in progress at the Grove Road station and a full-sized washing plant had been erected on which tests had been commenced.

Electrical Plant in Cinemas.

SIR ROBERT GOWER asked the Postmaster-General whether his attention had been called to the action of certain kinema proprietors in installing upon their premises electrical plant which created an interference in the ether and blotted out all broadcast reception in the immediate neighbourhood; and whether he would consider the desirability of obtaining powers to compel such modification of machinery as would abate this interference.

Mr. LEES-SMITH said that interference with broadcast reception was occasionally caused by the operation of electrical plant at cinemas and certain business premises. When complaints were received by his Department, representations were made to the proprietors, and it was found in nearly all cases that they were willing to make such alterations to their plant as would prevent the annoyance caused to their neighbours. It was not proposed to introduce fresh wireless legislation in the near future; but when the time came for such legislation the question of obtaining powers to deal with occasional cases of difficulty would be considered.

Electric Light in Prisons.

On January 30th Mr. P. OLIVER asked the Home Secretary whether his attention had been called to the recommendation contained in the last three reports of the visiting justices to the Manchester prison for the substitution of electric light for gas; and if he was prepared to take any action in the matter.

Mr. CLYNES said that the Manchester prison was one of a number at which the substitution of electricity for gas would be desirable. At various prisons progress had been made of recent years with the process of substitution so far as funds had permitted, but he had now under consideration the preparation of a more comprehensive scheme.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Joints for Aluminium Bus-bars.

Referring to the above article by Mr. W. E. Warner in your issue of the 24th instant, there are two points which, in our opinion, require slight modification.

Whereas, as he states, it is good practice to clean the joints and then smear them with vaseline, it is better to smear first and then clean. The latter method not only removes the thin film of natural oxide, but also prevents it reforming.

Mr. Warner suggests that contacts should be painted to prevent the ingress of moisture, but it is our experience that this is no more a necessity than in the case of a copper-copper joint. It may be advisable, however, in the case of an aluminium-copper connection.

British Aluminium Co., Ltd.,
EDGAR T. PAINTON.

London, E.C.4, *January 28th*, 1930.

Coal Mines Bill.

Some amendment of the provisions of the Coal Mines Bill to secure the equitable treatment of electricity supply undertakings seems necessary.

The Bill in its present form would establish a monopoly in the sale of coal without adequate safeguards against undue preference.

The various uses of coal in this country are in many respects alternatives to one another, and those engaged in the sale of coal and of other forms of energy produced from it are competitors. For example, domestic requirements for lighting, heating, and cooking may be supplied by the burning of coal, or by the use of coal-gas or of electricity. The colliery owners are concerned directly with the sale of domestic coal in competition with electricity supply undertakings, and it will be open to colliery owners (indeed an intention to do so has already been indicated) to offer domestic coal at a preferential price, so as to encourage its greater use in place of gas and electricity. Similarly, it has been suggested that the colliery owners might assist depressed industries by offering a preferential price, and reimburse themselves by charging an extra price to prosperous ones.

It is submitted that, in the public interest, the regulation of this proposed monopoly should be subject to the usual safeguards as to the limitation of profits, prescription of maximum prices, and prevention of undue preference to any class of consumer. Provisions of this nature are contained in the legislation regulating the supply of water, gas, and electricity under statutory powers, and there would seem to be the fullest justification for amending the Bill to make similar provisions in respect of the sale of coal in this country.

Statutory electricity supply undertakings are already seriously handicapped in relation to private power plant by the preference given to the latter in respect of rating; if they are also to be required to pay an extra price for coal, there is no doubt that their development will be seriously hindered, and the objects of the national electricity scheme made more difficult, if not impossible, of attainment.

The Bill should be amended to make it clear that the pithead price of any class of coal for home consumption should be fixed without regard to the purpose of use and on a basis which does not discriminate unfairly between statutory public utility undertakings and other users.

Leeds, *January 28th*, 1930. **W. B. Woodhouse.**

Ferranti.

In connection with the obituary notices and from the nice remarks which have been made regarding the late and kindly remembered Dr. de Ferranti, I wonder how many of your readers remember attending a dinner at the Midland Hotel, Manchester, between the years 1908 and 1910, at which the guests sang a song to the tune of a very popular comic song of that time. I remember some of the words, as follows:—

S.Z.D., we all agree, has got a splendid plan,
He's going to put cheap juice on tap for woman, child, and man,
He'll start his monster turbines up, and won't he make things hum,
And won't it be all fine, for gas we'll never pine in 1929,
We'll have volts on our fingers and amps. on our toes,
Dynamos will do it all, we shan't care if it snows.

. . . . . .

Alas! my poor memory has failed me as regards the rest, but I feel sure that it was published in your paper about that time.

It was almost prophetic, for in 1929 the grid scheme began to take effect.

H. Cobden Turner.

Salford, *January 27th*, 1930.

Standardisation.

The suggestion of some Australian States to standardise wall plugs of the flat-pin type, as against the round-pin type standardised here, raises once more a question of vital importance to manufacturers, not only of electrical apparatus, but as a whole. If manufacturers are to be able to produce in volume and economically, and the trade of the country is to expand and prosper, it will not be by continued narrowing of markets, or increases that are unnecessary or might reasonably be avoided, in patterns.

Australians, like ourselves, have been for years large users of round-pin plugs. The point for serious consideration, therefore, is what are the reasons that have led them to be now seriously considering standardising the flat pin after we have standardised the round.

After the many years of satisfactory service, both here, in Australia, and in other countries, of the round-pin plug, it is impossible to imagine that Australia has suddenly discovered in it some fundamental defect such as might reasonably be said to compel the change. It is not necessary for my present purpose to attempt a comparison of the respective detail merits, alleged or actual, of the two types. One may fairly and safely say that the normal functions for which a plug is required can reasonably equally well be carried out by either the British standard round or the American standard flat-pin types, and that the differences between them may be described as "selling points" only—open to argument and persuasion for and against, and as between buyer and seller!

There appears some doubt on the point, but one is entitled to assume it likely that in its standardising of the round plug our standardising authority would seek, as it proceeded, the co-operation and agreement of other similar and interested authorities, including the Australian Standards Association, and it is its apparent inability to secure, at any rate so far, the latter's agreement that is of prime importance to manufacturers; its failure to do so indicates, in effect, that the efforts of the supporters of the flat-pin type have evidently so far been more effective than those of the supporters of the round.

It appears to be essentially a question of salesmanship—somewhat national in character perhaps, and with standards instead of goods as the immediate issue. If we are satisfied that our standard is good, and if we wish Australia to confirm and retain it, we should be doing all the salesmanship demands under such circumstances, and putting our case in the strongest and most complete form. Whether this is being done, and if so, by whom and how, is the point that is of vital importance to the manufacturers of standard round pin sockets and plugs. British standards and British practice cannot, any more than British goods, be left or expected to sell themselves overseas.

Nothing in this letter must be construed as a desire to impose on the Dominions standards or practices they do not desire; they know best their conditions and must determine accordingly. Rather is it an attempt to draw attention to the desirability of British standards and British practice being well understood (and, it is hoped, thereby fully appreciated) abroad, and particularly in the Dominions, and to the fact that we appear to have no national organisation for doing this most important work.

T. R. Martin.

Birmingham, *January 28th*, 1930.

Heavy-oil Engines for Isolated Plant.

I have read your remarks concerning the recent private installation carried out by Mr. Kilburn Scott, M.I.E.E., with great interest, and I have no doubt that the significant installation at the Royal Merchant Seamen's Orphanage will be the forerunner of many others of equal importance.

The progress in the development of the oil industry, and all it means to the electrical power generating industry, is very clearly shown in the recent remarks of Mr. S. L. Naguinsky, the vice-chairman of the Russian Oil Products Company, Ltd., at Bristol. He stated that the production of oil in the Russian Republic, from which they obtain their supplies, was over 4,000,000,000 gallons in 1928 and 1929; that nearly £23,000,000 was invested last year in the oil industry of that country, and £92,000,000 during the past five years. In the next four years approximately £200,000,000 would be invested, and that the production would be 12,000,000,000 gallons. In 1929 over 200,000,000 gallons of Russian oil entered the United Kingdom ports, which represented an increase of over 60 per cent. over the imports of the previous year.

Coming directly from such a source, does it not indicate the enormous potentialities of the use of oil as the fuel for the production of really cheap electric power? The usefulness of the heavy-oil engine as a prime mover is very clearly shown in the case of Mr. Kilburn Scott's recent installation, and it is highly probable that a much extended use of the oil engine, and other such prime-movers, will now be made; it may even cheapen the cost of generation to the extent that even the electric road vehicle will at last come into its own, provided the steel-alkaline battery is used. There is no question whatever that large hotels, shops, and public buildings will now have seriously to consider the installation of their own generating plants once more, because of the great savings that are possible with this thermally efficient prime-mover, and the fact that its waste heat can be so easily and conveniently used for heating the buildings and for general hot-water supply.

William P. Durtnall (*Captain*).

London, S.W.1, *January 25th*, 1930.

Overhead-line Towers.

I have been most interested in the different articles and letters that have appeared from time to time in the electrical Press concerning the choice of the particular type of overhead-line towers so far employed for the national grid.

During the past three years I have had opportunities of studying to some extent several overhead transmission lines on the Continent, where, in general, great importance is attached (above all in Italy) to their perfection, not only from an engineering, but also from an æsthetic, point of view, owing to the naturally artistic temperament of the Latin races.

It is above all interesting to note that amongst the most important undertakings, the use of centrifugal ferro-concrete poles is very rapidly replacing the various forms of metallic structures, which at their best can never be anything but artistic monstrosities.

Since the leading transmission-line engineers on the Continent, where this branch of electric power supply is very advanced, appear to consider these metallic structures already as somewhat out-of-date and clumsy, what were the reasons which led us to adopt them for a system which must remain unchanged for many years to come?

Few people seem to have considered this very serious aspect of the question, although I noticed that after hearing the Wright-Marshall paper on the grid system read before the I.E.E. on January 24th, 1929, Mr. R. Borlase Matthews in the discussion had the matter very much in mind.

I should be very pleased indeed to hear the opinions of any of those who were intimately concerned with the evolution of this system, as, from the several documents which I have before me, it is quite apparent that the question of disfiguring the country-side as little as possible was considered an important factor.

R. A. White.

Charleroi, Belgium, *January 28th*, 1930.

Standardisation of Voltage.

In connection with the remarks of Mr. A. N. D. Kerr in the ELECTRICAL REVIEW of the 31st ult., one is compelled to wonder if the standardisation of voltage will ever be accomplished, in view of the fact that supply authorities at the present moment are carrying out schemes at 415 volts, 50 cycles, three phase. There are some districts in Northamptonshire that have been connected during the last two years with supplies at 460 volts, 50 cycles, single phase for power.

Taking the case of the 460-volt supply, this means that a power user has to pay as much as 50 per cent. more for motors and control gear than would be the case were the supply standard.

Until supply authorities themselves take the lead in the matter, standardisation will not mature.

R. H. Ashbee.

Peterborough, *February 1st*, 1930.

The Disadvantages of Prepayment Meters.

Mr. Griffiths's letter in your issue of January 17th was extremely interesting as giving the views of the actual users of prepayment meters.

The manufacturer has perforce to make his meters attractive in performance and price to the electricity supply undertaking which, it would seem, does not always consider the consumers of its product in the light of customers.

Mr. Griffiths's remarks are unfortunately true of other districts than his own, though it is not always the undertaking or the meter manufacturer who is to blame. Some years ago, in designing a prepayment meter, which is now on the market, contacts for ringing a warning bell or buzzer were embodied as standard. Though these prepayment meters are still supplied with this device, it is frequently not used, the reason stated being that the consumer is unwilling to bear any part of the cost of the additional wiring and bell.

As an example of the length to which the consumer's convenience has been considered, the contacts mentioned are arranged to ring the bell intermittently to prevent confusion with other bells which may be in use.

"Z.C.'s" comments in your issue of January 31st seem to miss the point. Surely it is all the more necessary to have some form of reminder that more coins are needed when there is a long and variable period between the occasions when coins have to be inserted.

With regard to added complication, this is negligible and should be, if it exists at all, purely a complication in manufacture. Reliability should not be affected, and certainly it is not in the Fox & Offord prepayment meter.

A. S. Giles,
Director,
FOX & OFFORD, LTD.,

Birmingham, *February 3rd*, 1930.

"Quote Our Reference."

If business houses would realise how much delay occurs in dealing with their correspondence when they omit to quote the references of the firms to whom they are communicating, I feel certain they would take all steps possible to ensure that they are never omitted.

It is astonishing how many firms ignore this important point, even where, as in the majority of cases, space is provided on their letter paper. They even go so far as specially to request that their own reference should be quoted, and then fail to respond to the request of others to do likewise.

It is such an easy matter to arrange, yet it seems so difficult to get it done. An instruction to the typist that no correspondence should leave the firm without the customer's reference being given (when known) should be sufficient to meet the purpose.

F. E. W.

January 29th, 1930.

I.E.E. Centre Dinners.

I observe in your issue of to-day's date an account of the Western Centre's dinner and a remark reported as having been made by Alderman Walker that it was the first Centre dinner to be attended by ladies. The gentleman, of course, is not an I.E.E. man, and possibly he may have meant the first Western Centre dinner, because in Scotland ladies have attended our dinners for quite a number of years, and, so far as I can see, have no expectation of making any departure from that most progressive and altogether satisfactory step.

Joseph Taylor,
Hon. Sec., SCOTTISH CENTRE,
INSTITUTION OF ELECTRICAL ENGINEERS.

Glasgow, C.2, *January 31st*, 1930.

Motor-convertors as Power Factor Correctors.

Will any reader be kind enough to supply me with a physical explanation of why over-exciting the d.c. field of a motor-convertor causes it to take a leading current from the a.c. mains?

A Mechanic.

February 3rd, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

19,431. "Electrolytic deposition of alloys." B. Leech and F. Hammond. July 4th, 1928. (323,765.)

19,472. "Electrical terminal." L. Marti-Schlaefli. July 5th, 1928. (323,714.)

19,534. "Electric discharge devices." Neon Lights, Inc. December 19th, 1927. (302,643.)

22,617. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 3rd, 1928. (323,766.)

25,952. "Electric circuit-breakers." British Thomson-Houston Co., Ltd., and H. C. Heath September 10th, 1928. (323,789.)

28,351. "Controllers for electric motors." T. S. Kemble. October 3rd, 1928. (323 752.)

28,679. "Electrical testing sets." W. Holmes and Ferranti, Ltd. October 5th, 1928. (323,772.)

28,841. "Radio transmitting systems." Westinghouse Electric & Manufacturing Co. October 8th, 1927. (2.8,481.)

28,904. "Thermionic valves." C. S. Franklin, J. G. Robb, and L. J. Golding. October 8th, 1928. (323,742.)

28,922. "Wireless receiving arrangements." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 8th, 1928. (323,744.)

28,923. "Telephone systems." Associated Telephone & Telegraph Co. November 12th, 1927. (300,497.)

29,112. "Loaded transmission systems for telephony and the like." Standard Telephones & Cables, Ltd. November 1st, 1927. (299,802.)

29,113. "Automatic or semi-automatic telephone exchange system." Standard Telephones & Cables, Ltd., and E. P. G. Wright. October 10th, 1928. (323,794.)

29,120. "Time switches for electric circuits." Landis et Gyr Soc. Anon. December 6th, 1927 (301,820.)

29,170. "Electric junction boxes and the like, and insulators therefor." C. A. Jeffers and J. R. Whincop. October 10th, 1928. (323,799.)

29,279. "Impulse-controlling arrangements for use in electrical signalling systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). October 11th. 1928. (323,804.)

29,295. "Electric rectifier systems." Associated Electrical Industries, Ltd. October 11th, 1927. (298,576.)

29,582. "Cooling of oil-immersed electric transformers." British Electric Transformer Co., Ltd., and J. L. Thompson. October 13th, 1928. (323,814.)

30,128. "Reflector for use with mercury-vapour lamps." B. J. Hall. October 18th, 1928. (323,822.)

30,131. "Arrangements for amplifying electrical oscillations." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 18th, 1928. (323,823.)

30,196 "Thermionic valves of the screened-grid type." A. Preen. October 18th, 1928. (323,826.)

30,571. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 29th, 1927. (299,704.)

30,778. "Methods of and means for recording and reproducing sound." R. A. Kennedy. October 24th, 1928. (323,833.)

30,856. "Methods of and furnaces for annealing wire or band-rings of iron or another metal by inductive heating." R. Arpi and G. J. M. Dahlquist. October 24th, 1928. (323,835.)

31,234. "Method of winding and constructing electrical heating elements." C. Russ. October 27th, 1928. (323,837.)

32,006. "Thermionic valves." C. S. Franklin. November 2nd, 1928. (323,849.)

32,380. "Frequency-control devices suitable for radio and the like transmitters." C. S. Franklin. Novembe 6th, 1928. (323,853.)

32,451. "Electrical plug-and-socket couplings." J. A. Crabtree. November 7th, 1928. (323,854.

32,508. "Temperature-actuated electric switching device." Akt.-Ges. der Maschinenfabriken Escher, Wyss et Cie. December 15th, 1927. (302,344.)

33,079. "Brushes for small electric motors." Electrolux, Ltd. (Inventia Patent-Verwertungs Ges.). November 12th, 1928. (323,857.)

33.457. "Means for nullifying voltage fluctuations in electrical circuits." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 15th, 1928. (323,862.)

33,899. "Electrically-wound clocks." British Thomson-Houston Co., Ltd. November 18th, 1927. (300,915.)

34,439. "Adjustable arms for supporting telephones, electric lights, and similar objects." W. P. Grafton and W. Grafton & Son, Ltd. November 22nd, 1928. (323,870.)

34,759. "Electric transformers." S G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken) November 26th, 1928. (323,873.)

34,954. "Electric motor control systems." L. Miller, R. Brooks and Associated Electrical Industries, Ltd. November 27th, 1928. (323,875.)

35,078. "Circuit arrangements for connection lines in signalling systems, and particularly in telephone systems." Siemens & Halske Akt. Ges. December 6th, 1927. (301,828.)

35,427. "Device for use on motor-meters for indicating instantaneous values of the energy, current, or related quantities." Landis & Gyr Soc. Anon. January 24th, 1928. (304,684.)

36,000. "Electrical contacts and contact arrangements." Siemens Bros. and Co., Ltd., and F. Baker. December 6th, 1928. (323,887.)

36,017. "Electric circuit interrupters." Associated Electrical Industries, Ltd. December 9th, 1927. (301,917.)

36,121. "Electric apparatus for heating articles by induction." P. Viry. December 12th, 1927. (302 234.)

36,280. "Vacuum electric tube devices." E. Y. Robinson, E. J. E. Hubbard and Associated Electrical Industries, Ltd. December 8th, 1928. (323,888.)

36,851. "Electric drive arrangements for motor vehicles." J. Sousedik. December 13th, 1928. (323,890.)

36,951. "Selecting switches, such as used in automatic telephone systems." Siemens Bros. & Co., Ltd., E. A. Petithory, and E. A. Forceville. December 14th, 1928. (323,892.)

36,953. "Selecting switches, such as used in automatic telephone systems." Siemens Bros. & Co., Ltd., E. A. Petithory, and E. A. Forceville. December 14th, 1928. (323,893.)

37,654. "Circuit arrangement for connection lines in signalling systems, and particularly in telephone systems." Siemens & Halske Akt. Ges. July 11th, 1928. (Addition to 301,828.) (315,297.)

38,470. "Electric supply systems." General Electric Co., Ltd., R. Orsettich and M. Kahn. December 31st, 1928. (323,907.)

1929.

17,698. "Condenser microphones." British Thomson-Houston Co., Ltd. June 13th, 1928. (313,519.)

25,693. "Thermally-operated electric switches of the fluid-pressure type." I. E. McCabe. September 3rd, 1928. (Divided application on 322,511.) (323,514.)

38,169/71. "Dynamo-electric machines." B. C. von Platen, and L. A. G. Reiland. July 3rd, 1928. (Divided applications on 323,498.) (323,549/51.)

732. "Apparatus for the simultaneous reproduction of pictures and sounds." Gramophone Co., Ltd., and A. Whitaker. January 8th, 1929. (323,923.)

5,440. "Radio-receiving aerial systems." Telefunken Ges. für Drahtlose Telegraphie. February 18th, 1928. (306,418.)

5,492. "Means for indicating when electric current is flowing in a circuit." J. H. Runbaken and G. W. Melland. February 19th, 1929. (323,932.)

5,683. "Electric tachometer." A. Schwarz and Dr. B. Lange. February 20th, 1929. 323,953.)

7,470. "Induction type electrical instruments or relays." General Electric Co., Ltd., H. C. Turner and W. Hamilton. March 7th, 1929. (323,966.)

8,965. "Electric tumbler switches." Trevelyans (Birmingham), Ltd., and T. Gladdy. March 20th, 1929. (323,974.)

9,818. "Automatic battery-charging device for telephone exchanges." Standard Telephones & Cables, Ltd. (R. Schenk). March 27th, 1929. (323,981.)

11,348. "Electric induction furnaces." Allmänna Svenska Elektriska Aktiebolaget. April 21st, 1928. (310,031.)

11,753. "Electromagnetic device for imparting an intermittent pendular movement to a swinging member." Bing Werke vorm Geb. Bing. Akt. Ges. April 19th, 1928. (310,003.)

12,588. Starting of polyphase electric motors by means of auto-transformers." Ateliers de Constructions Electriques de Charleroi. August 30th, 1928. (Addition to 281,974.) (318,195.)

15,045. "Inductor furnaces." E. F. Northrup. August 2nd, 1928. (316.659.)

15.196. "Current collectors for electric vehicles." G. Fischer. March 19th, 1929. (323,994.,

15,490. "Oil-filled lead-covered electric cables." British Thomson-Houston Co., Ltd. May 18th, 1928. (312.081.)

22,658. "System for transmitting alarm signals." Siemens & Halske Akt. Ges. December 20th, 1927. (Divided application on 302,678.) (316,148.)

23,434. "Television and like apparatus." J. L. Baird and Television, Ltd. October 10th, 1928. (Divided application on 29,177/28.) (323,817.)

24,248. "Television and like apparatus." J. L. Baird and Television, Ltd. October 12th, 1928. (Divided application on 29,505/28.) (323,818.)

37,103. "Electric ship-propulsion systems." British Thomson-Houston Co., Ltd., and G. O. Watson. September 7th, 1928. (Divided application on 25,709/28.) (323,763.)

37,104. "Electric power supply systems." British Thomson-Houston Co., Ltd., and G. O. Watson. September 7th, 1928. (Divided application on 25,709/28.) (323,730.)

37,106. "Speed measuring and indicating apparatus." British Thomson-Houston Co., Ltd., and G. O. Watson September 7th, 1928. (Divided application on 25,709/28.) (323,746.)

37,107. "Protective systems for alternating-current electric generators." British Thomson-Houston Co., Ltd., and G. O. Watson. September 7th, 1928. (Divided application on 25,709/28.) (323,764.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates shown :—

JANUARY 22nd.

Liver. No. 505,128. Class 5. Wire and unwrought and partly-wrought metal for use in the manufacture of electrical goods. No. 508,133. Class 18 Engineering, architectural, and building contrivances for electrical purposes.—Liverpool Electric Cable Co., Ltd., Bootle, Lancs.

Volta. No. 505,617. Class 6. Vacuum cleaning machines.—Volta, Ltd., 80, Finsbury Pavement, E.C.2.

Hypermite. No. 507,136. Class 6. Radio-telephonic and telegraphic instruments and apparatus.—Radio Instruments, Ltd., 12, Hyde Street, W.C.1.

Extenscale. No. 507,254. Class 8. Electrical resistances and transformers, ammeters, voltmeters, wattmeters, galvanometers, and similar electrical testing apparatus.—Elliott Bros. (London), Ltd., 1, Central Buildings, Westminster, S.W.1.

Sempelis. No. 508,505. Class 8. Radio-telephonic apparatus and parts thereof.—Fanny Alford, The Nook, Rockbeare, near Exeter.

Secos. No. 509,047 Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Lissen, Ltd., Friar Lane, Richmond, S.W.

Crescent. No. 504,088. Class 18. Electric heating stoves.—Albert Phillips, Ltd., Eyre Street Spring Hill, Birmingham.

Spartol (lettering and design). No. 505,845. Class 47 A cleaning and lubricating preparation for commutators and slip-rings of dynamo-electric machinery.—W. Dymond, Elmleigh, Millbrook Lane, Millbrook, Hants.

JANUARY 29th.

Viking. No. 505,742. Class 6. Domestic vacuum cleaning machines, electric fans, and electrically-driven sewing machines for domestic use.—L. S. Marchant, 54, Aston Avenue, Fallowfield, Manchester.

Radio Service (London), Ltd. (lettering and design). No. 507,205. Class 8. Electric accumulators (not for medical purposes).—Radio Service (London), Ltd., 105, Torriano Avenue, Camden Town, N.W.5.

Infinity. No. 508,295. Class 8. Electric cables. No. 508,296. Class 40. Electric wires covered with india-rubber.—Sloan Electrical Co., Ltd., 8-12, Golden Lane, E.C.1.

Televisorgram. No. 508,527. Class 8. Apparatus for use in transmitting views, scenes or images, and sounds to a distance by telegraphy.—Baird Television Development Co., Ltd., 133, Long Acre, W.C.2.

Goliath. No. 508,657. Class 8. Loud-speakers and sound-amplifying apparatus.—British Blue Spot Co., Ltd. 204-206, Great Portland Street, W.1.

Cynthia. No. 508,696. Class 8. Radio-telephonic apparatus, &c.—J. W. Dugmore, Ltd., 42, Waterloo Road, Smethwick.

S. H., Siemens & Halske (lettering and design). No. 508,247. All goods in Class 10.—Siemens & Halske Gesellschaft, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildinhgs, Chancery Lane, W.C.2.)

L. E. C. (lettering and bird design). No. 505,075. All goods in Class 17. No. 505,077. Class 20. Electric lighting, heating, telephonic, telegraphic, and radio-telephonic and television apparatus.—Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Lancs.

Ascot. No. 505,834. Class 18. Cooking stoves geysers, and stove boilers, all heated by electricity or gas.—Cookers & Geysers, Ltd., 244, High Holborn, W.C.1.

Thermovisor. No. 509,003 Class 18. Engineering, architectural, and building contrivances.—Electric Central Heating and Ventilating Co., Ltd., 157, West George Street, Glasgow.

Novotext. No. 496,235. Class 50. Electrical insulating material.—Allgemeine Elektricitäts Gesellschaft, Berlin. (British representatives: Edward Evans and Co., 27, Chancery Lane, W.C.2.)

Crommoid. No. 506,491. Class 50. Synthetic resin for industrial purposes and articles made therefrom, including electrical insulating material, columns and mouthpieces for telephones, bases for electrical apparatus, switch covers, &c.—Cromwells, Ltd., Tipton Road, Dudley Port, Staffs.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHBY-DE-LA-ZOUCH.—Extensions to Grammar school (£16,000); clerk to the governors.

BARNET.—Grammar school (£50,198), for Herts. E.C.: director of education, Hertford.

BARNSLEY.—Factory extension, Peel Street; P. A. Hinchliffe, architect, Market Hill. Factory extensions, Stocks Lane; J. Horkin, builder, Liversedge, Yorks.

BATH.—Hospital, with X-ray department, and nurses' home, Combe Park; P. Adams, of Adams, Holden & Pearson, 9, Knightsbridge, London, and Alfred J. Taylor, Bath, architects.

BEXHILL-ON-SEA.—Entertainments pavilion (£50,000), for the T.C.; Tubbs & Messer, architects.

BIRMINGHAM.—Hospital, Edgbaston; Lanchester & Lodge, architects, 19, Bedford Square, London, W.C.1.

BLACKBURN.—Baths, Mill Hill; borough engineer.

BRADFORD.—Premises, with electrical work, for Messrs. E. W. Busby; Penty & Margetts, 1, Hustlergate.

BRIDLINGTON.—Two schools (800 places), for the borough E.C.; director of education.

BRISTOL.—Factory, for the Imperial Tobacco Co., Ltd.

CAMBRIDGE.—County Hall (£53,000), for Cambs. C.C.; county architect.

CHELMSFORD.—Schools, Lady Lane and Boarded Barns estate, for the E.C. Ward block, out-patients and casualty wing and extensions to nurses' home, Chelmsford and Essex Hospital; the governors.

CROYDON.—Houses (92), Cromer Road; Steel & Howes, Farnley Road, S.E.25. Houses (55), Pilgrims Close; R. Pierson, 47, Wakehurst Road, S.W.11. Houses (44), Downsview Road; borough engineer. Three new schools and enlargement of five existing schools, for the E.C. Nurses' home, Mayday Road Hospital (£2,579), for the B.G.; R. Mansell, builder. Baths, Mitcham Road (£17,151); H. & F. Roll, Ltd., Epsom. Reconstruction, West Croydon station; Southern Railway Co.

DEVIZES.—Hospital block, for Devizes and Pewsey Joint Isolation Hospital Committee; H. H. Baker, clerk.

DEWSBURY.—Girls' secondary school (£48,900), technical college extensions (£12,000), and elementary schools (£47,380), for the Borough E.C.; director of education.

DUKINFIELD.—Senior school (£40,000), for the Borough E.C.; director of education.

EAST LOTHIAN.—Houses (100), for East Lothian Western District Committee (£30,444); Richard Baillie, builder, Pencaitland.

ECCLES.—Two schools for the Borough E.C.; director of education.

FENTON.—Baths, Pratt's works site; Stoke-on-Trent city engineer.

GILLINGHAM (KENT).—Schools, Napier Road and Rainham, for the Borough E.C.; borough surveyor.

GLASGOW.—Employment exchange, Kinning Park; architect, H.M. Office of Works, 122, George Street, Edinburgh.

GUILDFORD.—Houses (44), Stoughton estate; H. Ashenden. Buildings at Grammar school (£19,260); the governors.

HERNE BAY.—Rebuilding baths and café, St. Georges Parade; R. Messenger.

HOYLAKE & WEST KIRBY.—Reconstruction of baths (£25,000), for the U.D.C.; surveyor.

IRISH FREE STATE (CLONMEL, Co. TIPPERARY).—Additions, Mental Hospital; alterations and additions, Workhouse, with electrical work; Acting Resident Medical Superintendent, District Mental Hospital (returnable deposit of £6 6s. each section).

KINGSTON (SURREY).—Two swimming and 50 slipper baths, for the T.C.

LAINDON.—School (680 places), for Essex E.C.; W. O. Lester Smith, director of education, Chelmsford.

LEICESTER.—Nurses' home, Mental Hospital (£28,000); T. Trevor Sawday, architect.

LEYLAND.—Grammar school (£43,387), with electrical and heating work, for Lancs. E.C.; county architect, Preston.

LICHFIELD.—Hospital, for the Victoria Cottage Hospital Committee; Thomas A. Pole, architect.

LONDON (WEST HAM, E.).—Nine schools (£406,245), for the Borough E.C.; director of education.

(POPLAR, E.).—Extensions, School of Engineering and Navigation (£24,928); A. E. Symes, Ltd., Stratford.

(WHITECHAPEL, E.).—Reconstruction, Pavilion Theatre; Theatre Co.

(ST. PANCRAS, N.W.).—Reconstruction, Euston Square station; Metropolitan Railway Co.

(SOUTHWARK, S.E.).—Reconstruction, Elephant & Castle Theatre; Theatre Co.

(ELTHAM, S.E.).—Development, Horn Park estate; R. J. MacKenzie & Sons, Ltd.

(BATTERSEA, S.W.).—Tenements (270), St. John's College site; borough engineer.

(STREATHAM, S.W.).—Houses (46), Leigham Court Road; F. T. Wooding.

(NORBURY, S.W.).—Houses (46), Maryland Road; J. T. Keen and Sons, 47, Mitcham Lane, S.W.16.

MACCLESFIELD.—Senior and junior schools for the Borough E.C.; director of education.

MEIR.—Housing schemes (27 acres), at Weston Road and Uttoxeter Road; Stoke-on-Trent city engineer.

MENSTON.—Detached residence at Mental Hospital, for West Riding Mental Hospitals Board; W. E. H. Burton, architect and engineer, West Riding Mental Hospitals Board, offices, Wakefield (deposit £1).

MORDEN.—R.C. Church, St. Helier estate; Catholic trustees. Wesleyan Church, St. Helier estate; Wesleyan authorities.

NEWBURY.—Sewage works (£32,500); Howard Humphreys and Sons, engineers.

NORTHAMPTON.—Houses and branch library, St. Davids site; borough engineer.

PRESTON.—Employment exchange; H.M. Office of Works (Contracts Branch). Works, Red Scar estate, Ribbleton, for Courtaulds, Ltd.

RASTRICK.—Extensions, Longroyde Schools, with electrical work; Sharp & Waller, architects, 32, Bradford Road, Brighouse.

ROCHDALE.—Housing scheme (200), Clover Hall Place, Belfield; borough surveyor.

SALE.—Extension of Town Hall and Public Library; clerk to U.D.C., Town Hall.

SALFORD.—Cinema, Ordsall Lane and Regent Road (1,450 seats); borough surveyor.

SOMERSET.—Schools and extensions (£470,326), for the E.C.; director of education, Taunton.

SPRINGFIELD.—Extensions, Mental hospital (£36,500); Middlesex C.C.

STOCKPORT.—'Bus garage and offices, Charles Street, for North Western Road Car Co., Ltd.; Mark Lane, Limited, builders and contractors, Heaton Lane. Waterworks; borough waterworks engineer.

STOKE-ON-TRENT.—Ward and extension of administrative block at sanatorium; city engineer. Baths; Corporation Baths Committee.

SURREY.—Schools at Surbiton, Cheam, and Sutton, for the County E.C.

THORNE.—Houses (100); H. Plewes, architect, Council Offices.

THORNTON HEATH.—Houses (89), Benet and other roads; Truett & Steel, High Street. Extensions, Baths (£30,000); Croydon borough engineer.

TIMPERLEY (CHES.).—Hotel, Manchester Road, for Groves and Whitnall, Ltd, Regent Road Brewery, Salford; Chas. Clegg & Son, 30, Brown Street, Manchester.

TYNEMOUTH.—Reconstruction of the Plaza Cinema (£20,000); borough engineer.

WADDON.—Houses (500), Waddon housing estate; Croydon borough engineer.

WALLASEY.—Public wash-house, electrically equipped (£15,000); borough surveyor.

WALSALL.—Library, Leamore; borough engineer.

WESTON-SUPER-MARE.—Re-erection of the Grand Pier Pavilion, electrically equipped (£70,000), for the Grand Pier Co.; Albert Bloomfield, manager and secretary.

WEYMOUTH.—Central school (£21,000), for the E.C.

WORKSOP.—R.C. Church; Rev. Canon Hayward.

WREXHAM.—Housing scheme (57), Huntroyde estate, for the T.C.; J. England, borough engineer (returnable deposit of £3 3s.).

YORK.—Houses (39), Tuke Avenue; city engineer. Shops and offices, Piccadilly; W. Dove & Sons, Ltd.